

Phaseoleae (10.01–10.83)

Genus: *Erythrina* C. Linnaeus

Phylogenetic Number: 10.01.

Tribe: Phaseoleae.

Subtribe: Erythrinae.

Species Studied—Species in Genus: 85 spp.—112 spp.

Fruit a legume (breaking between seed chambers into “articles”) or nutlet; unilocular; $4\text{--}24 \times 1\text{--}3 \times 0.5\text{--}2$ cm; with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight, curved (or slightly curved), or 1- or 2-coiled (rarely); not plicate; not twisted; asymmetrical or symmetrical; moniliform, fusiform, linear, falcate and moniliform, falcate, or irregular; when asymmetrical with both sutures parallelly curved, both sutures unequally curved, or 1 suture straight and 1 curved (rarely); widest near middle or D-shaped; not inflated; compressed or terete; with or without beak; straight, declined, hooked, or coiled; with solid beak the same color and texture as fruit; long tapered, tapered, or short tapered at apex; apex aligned with, oblique with, right-angled with, almost reaching, or exceeding (crossing, rarely) longitudinal axis of fruit; long tapered or tapered at base; base aligned or oblique with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous, leathery, ligneous, or fleshy (rarely); seed chambers externally visible or invisible; with the raised seed chambers not torulose or torulose (sometimes). Fruit margin constricted or not constricted; constricted or slightly constricted along both margins or constricted or slightly constricted only on 1 margin; without sulcus; embellished or plain; with thickened sutural areas or wings. Fruit wings absent or present (rarely); 3; up to 5 mm wide; sutural (two on ventral suture, 1 on dorsal); on both sutures. Fruit stipitate or nonstipitate; with the stipe up to 44 mm long. Fruit with all layers dehiscent or indehiscent (rarely); splitting along sutures. Dehiscence of valves along both sutures or 1 suture; apical and down; active; with valves twisting or coiling (rarely). Replum invisible or visible (rarely). Epicarp dull; monochrome or multicolored; mottled; brown, black, or tan; with black or brown overlay; glabrous, glabrate, or pubescent and indurate; with 1 type of pubescence; tomentose; with pubescence golden or brown; with pubescence uniformly distributed; with

simple hairs; pliable; with hair bases plain; eglandular; without or with spines; with spines persistent; with spines same color (but slightly paler) as the rest of the fruit; smooth or not smooth; with elevated features; veined or not veined; reticulately veined; not tuberculate; wrinkled or muricate; not exfoliating; without or with cracks; cracking irregular. Mesocarp thick, thin, or trace; 1- or 2-layered; without balsamic vesicles; without fibers; spongy or solid (in literature); with spongy layer over solid layer; subligneous, coriaceous, or chartaceous. Endocarp dull; monochrome or mottled; tan or brown (to dark brown); with mottling (dark); with brown or black overlay; smooth; septate, subseptate, or nonseptate; with septa thin (tissue paper-like), flexible or thicker than paper, firm; with septa eglandular; chartaceous or ligneous (rarely, according to the literature); exfoliating, exfoliating in part, or not exfoliating; remaining fused to mesocarp and epicarp, separating from mesocarp (which also separates from epicarp), or separating with mesocarp from epicarp. Seeds (1–)2–12; length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; up to 3.5 mm long; of 1 length only; flattened or thick; straight, triangular, or contorted. Aril absent or present; dry; rim-aril, tongue-aril, or partial rim-aril; fimbriate or entire; brown or tan.

Seed $5\text{--}45 \times 4\text{--}20 \times 5\text{--}20$ mm; not overgrown; not angular; asymmetrical or symmetrical; circular, elliptic, oblong, ovate, or reniform (sometimes flattened on end opposite radicle); terete to compressed; with surface smooth or ridged (dorsally); without or with visible radicle and cotyledon lobes; without external groove between radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; dull or glossy; not modified by a bloom; colored; monochrome, bichrome, or mottled; with frequent mottles; red, orange, brown, black, red and black, or tan to yellow; with brown (dark) or black overlay; glabrous; smooth or rarely not smooth; with elevated or recessed features; wrinkled (on drying); pitted with small separate pits; osseous or coriaceous. Fracture lines absent. Rim absent. Wings absent. Raphe visible or not visible; from lens to base of seed and bifurcating or from hilum through lens and base of seed to point opposite hilum; not bifurcating; color of testa; slightly raised. Hilum visible, partially concealed, or fully concealed; concealed by funiculus, funicular remnant, aril, or aril remnant; with faboid split; with the lips of the faboid split the same color as or lighter colored than the rest of the hilum and therefore con-

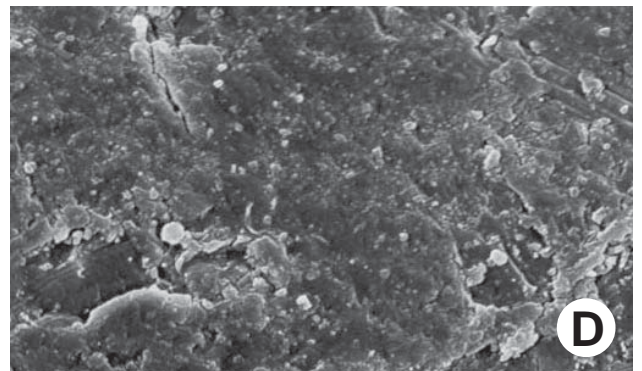
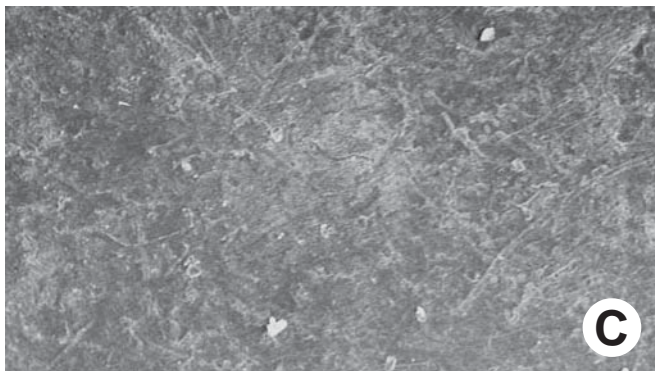
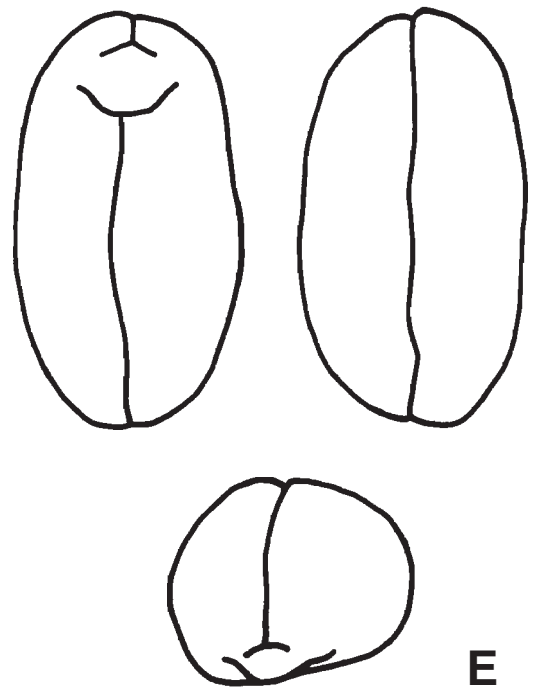
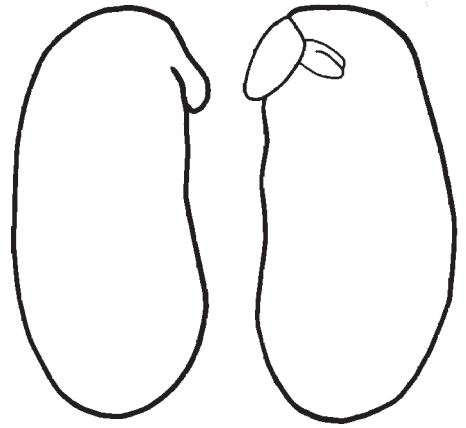
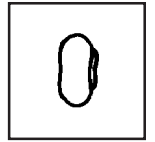
spicuous; larger than punctiform; 2–10.5 mm long; with curved outline; elliptic to oval; apical according to radicle tip but marginal according to seed length or marginal according to radicle tip; flush, recessed, or raised; not within corona, halo, or rim or within halo or rim. Hilum halo color lighter or darker than testa. Hilum rim color of or darker than testa. Lens discernible; equal to or greater than 0.5 mm or less than 0.5 mm in length; up to 5.3 mm long; with margins straight or curved; linear, rhombic, wedge-shaped, elliptic, ovate, punctiform, or circular; not in groove of raphe; confluent with hilum; flush, mounded, or recessed; same color as, similar color as, or dissimilar color from testa; lighter or darker than testa; black; not within corona, halo, or rim or within halo. Lens halo color darker than testa. Endosperm absent. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees or not entire 180 degrees from base of radicle; notched, wavy, or bearing flaps; similar at apex; partially concealing radicle; notched at or split over radicle; without lobes; with the interface division terminating at base of radicle; without or with (rarely) 1 margin recessed; recessed on same side as radicle; white, yellow (pale), or tan; inner face flat or concave (slightly); glabrous around base of radicle. Embryonic axis oblique; oblique or parallel to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; triangular or bulbous; lobe tip straight or curved; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule moderately or well developed; glabrous.

Distribution: Pantropics and pansubtropics.

Notes: Phaseoleae is the tribe with the most species whose seeds are used as human food on a large scale (Schery 1972; Duke 1981; Maesen and Somaatmadja 1989; Wiersema et al. 1990). In general the seeds of this tribe are considered as the archetypical seeds of subfamily Faboideae. Bruneau et al. (1995) carried out cladistic analyses of tribe Phaseoleae using chloroplast DNA restriction site data. Their results indicated that the tribe is not monophyletic and that the tribal delimitations between Phaseoleae and Desmodieae (11) and between Phaseoleae and Millettieae (7) are problematic. Krukoff and Barneby (1974) monographed *Erythrina* and recognized 105 species, and Gunn and Barnes (1977) described the seeds of 101 species. Neill (1988) studied the biosystematic relationships of the species of

Erythrina and recognized 112 species, four more than Lackey (1981b). Adema (1996) synonymized *E. stricta* and *E. suberosa* W. Roxburgh and accepted *E. stricta* as the correct name. Bruneau (1996) studied the chloroplast DNA of 51 *Erythrina* species. She concluded that a paraphyletic group of South American species is basal in the genus and that two main clades are derived from it. One is South American and Mexican and the other is Asian, from which is derived a New World group and an African clade with derived Asian and South American species.

Erythrina: *E. stricta* W. Roxburgh (*C–E*), *E. spp.* (*A–B*). *A*, Fruits ($\times 0.5$); *B*, seeds ($\times 1.4$); *C–D*, testa ($\times 50$, $\times 1000$); *E*, embryos ($\times 5$).



Genus: *Strongylodon* J.R.T. Vogel

Phylogenetic Number: 10.02.

Tribe: Phaseoleae.

Subtribe: Erythrinae.

Species Studied—Species in Genus: 2 spp.—12 spp.

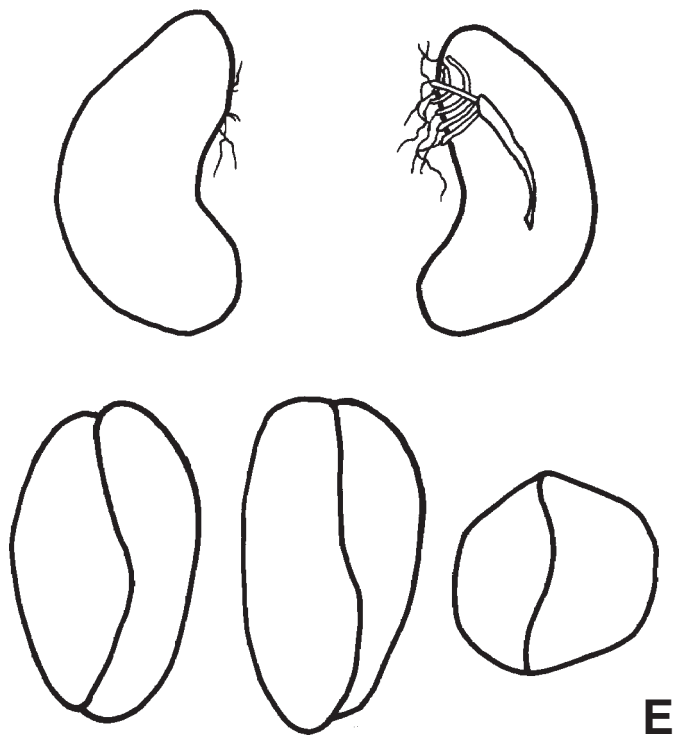
Fruit a legume; unilocular; $4\text{--}36 \times 2\text{--}6 \times 1.2\text{--}4$ cm; with deciduous calyx; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; symmetrical or asymmetrical; ovate (or nearly so), oblong, linear (Huang 1991), moniliform (Huang 1991), or irregular; when asymmetrical with both sutures parallelly or unequally curved; inflated or not inflated; terete; without or with beak; straight, coiled (Huang 1991), or hooked; with solid beak the same color and texture as fruit; short tapered or rounded at apex (Huang 1991); apex aligned or right-angled with longitudinal axis of fruit (Huang 1991); tapered or short tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; chartaceous to leathery or fragile, thinner than chartaceous like *Trifolium* (21.06); seed chambers externally visible or invisible; with the raised seed chambers not torulose. Fruit margin not constricted; without sulcus; plain or embellished; with thickened (slightly) sutural areas. Fruit wings absent. Fruit stipitate or nonstipitate (Huang 1991); with the stipe 2–13 mm long. Fruit with all layers dehiscing or indehiscent; splitting along sutures. Dehiscence of valves along both sutures; apical and down. Replum invisible. Epicarp dull; monochrome; tan to brown; glabrous; eglandular; without spines; not smooth; with elevated features; veined or not veined; reticulately veined; not tuberculate; rugose; exfoliating in part; with or without cracks; cracking irregular. Mesocarp present or absent; thin; 1-layered; without balsamic vesicles; fibrous throughout; chartaceous. Endocarp dull; monochrome; tan or yellow (golden); smooth; nonseptate or subseptate (*S. loheri* S.-F. Huang); chartaceous; exfoliating; separating from epicarp; entire. Seeds 1–12; length parallel with or transverse to fruit length (Huang 1991); neither overlapping nor touching; in 1 series. Funiculus measured; up to 55 mm long; assumed of 1 length only; partially filiform and partially thick; straight or triangular. Aril absent.

Seed $9\text{--}40 \times 9\text{--}34 \times 12.6\text{--}33$ mm; not overgrown; angular or not angular; asymmetrical; nearly circular, D-shaped (rounded), or irregular; terete (to wider than thick); with surface ridged or smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering or partially adhering to endocarp; dull; not modified by a bloom; colored; monochrome; dark brown; glabrous; smooth or not smooth; with recessed features; cracked; coriaceous or chartaceous. Fracture lines absent or present; transverse. Rim absent. Wings absent. Raphe not visible. Hilum fully concealed by funicular remnant; without faboid split; larger than punctiform; 45–55 mm long; with curved or straight outline; circular or linear (around 3/4 of seed); marginal according to radicle tip; raised or recessed; within rim or not within corona, halo, or rim. Hilum rim color of testa. Lens discernible or not discernible; equal to or greater than 0.5 mm in length; up to 1.5 mm long; with margins straight; linear; not in groove of raphe; adjacent to hilum; recessed; same color as testa; brown; not within corona, halo, or rim. Endosperm present or absent; thin; covering entire embryo; adnate to embryo. Cotyledons smooth or not smooth; sulcate; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing radicle; split over radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; tan; inner face flat to concave (slightly); glabrous around base of radicle. Embryonic axis oblique; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle slightly differentiated from cotyledon; linear or triangular; lobe tip straight; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule moderately to well developed; glabrous.

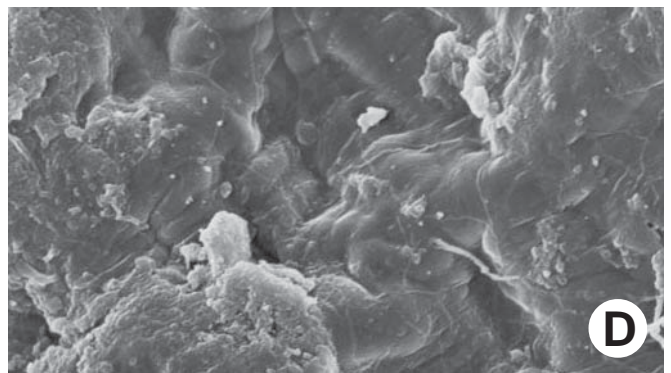
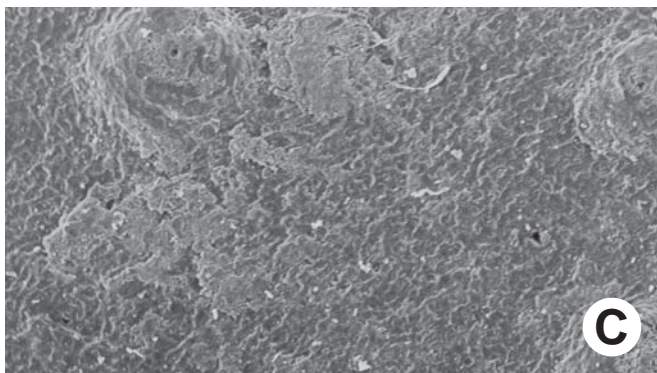
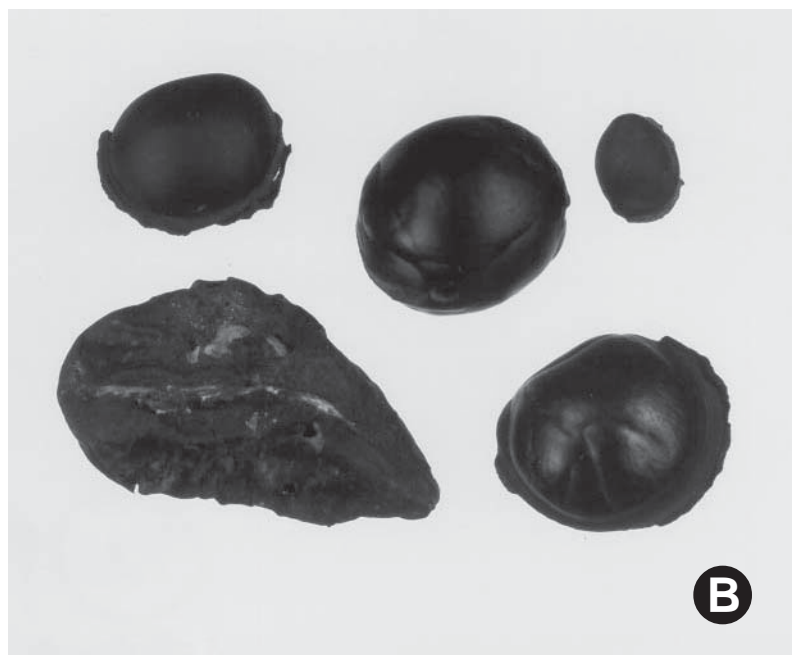
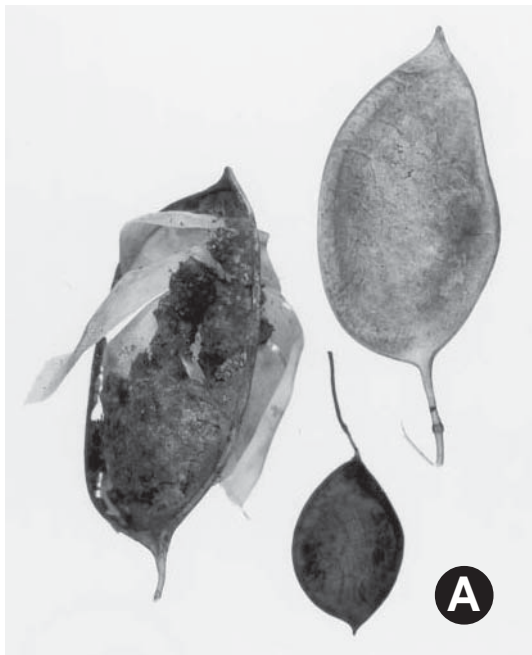
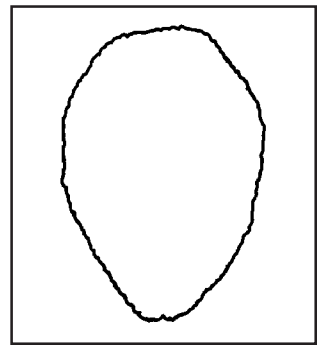
Distribution: Madagascar to Polynesia.

Notes: *Strongylodon* has 20 species according to Lackey (1981b). Huang (1991) monographed the genus and recognized 12 species, and we used the latter count. The embryo is very unusual. The plumule is highly developed. The radicle points towards the center of the cotyledons, and the epicotyl points to the outside of the cotyledons. Consequently, the plumule is exerted from the cotyledons, and the radicle is near their center.

Strongylodon: *S. macrobotrys* A. Gray (C–E), spp. (A–B). A, Fruits ($\times 0.6$); B, seeds ($\times 1.3$); C–D, testa ($\times 50$, $\times 1000$); E, embryos ($\times 1$).



E



Genus: *Mucuna* M. Adanson

Phylogenetic Number: 10.03.

Tribe: Phaseoleae.

Subtribe: Erythrinae.

Species Studied—Species in Genus: 32 spp.—100 spp.

Fruit a legume (breaking between seed chambers into “articles”) or nutlet; unilocular; $5\text{--}53 \times 2\text{--}5 \times 0.5\text{--}2.5$ cm; with persistent or deciduous calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight or curved (slightly); not plicate; not twisted; asymmetrical or symmetrical; linear, moniliform, oblong, falcate, elliptic, fusiform, ovate, S-shaped, or irregular; when asymmetrical with both sutures parallelly or unequally curved; not inflated; flattened or compressed; without or with beak; declined; with papery fragile beak up to 1 cm long or solid beak the same color and texture as fruit; long tapered, tapered, short tapered, rounded, truncate, or cordate at apex; apex aligned, oblique, or right-angled with longitudinal axis of fruit; long tapered, tapered, or truncate at base; base aligned or oblique with longitudinal axis of fruit; with the apex and base uniform in texture; leathery, ligneous, or fragile, thinner than chartaceous like *Trifolium* (21.6); seed chambers externally invisible or visible; with the raised seed chambers not torulose. Fruit margin not constricted or constricted; constricted along both margins; without sulcus; embellished or plain; with ridges, thickened sutural areas, or wings. Fruit wings present or absent; 4; 3–15 mm wide; valvular (2 longitudinal on each valve) or sutural (2 on each suture, sometimes undulate or dentate marginally); on both valves; on both sutures. Fruit nonstipitate to substipitate to stipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome; black, brown, or green; with surface texture uniform or not uniform, with patches of different texture not restricted to the base and apex; pubescent and indurate and pubescent but soon deciduous, pubescent and indurate, or pubescent but soon deciduous; with hairs erect or appressed (occasionally); with 1 or 2 types of pubescence; pilose or velutinous; with pubescence golden (reddish), red (brownish), tan, or brown (to dark brown); with longitudinal bands of lighter and darker brown; with pubescence uniformly distributed; with simple and complex hairs; with bristle-

like hairs (irritating); stiff; with hair bases plain; straight (with minute barbs in literature); straight at apex; eglandular; without spines; not smooth; with elevated or recessed features; veined or not veined; finely, reticulately veined; not tuberculate; ribbed (ribs up to 6 mm, sometimes T-shaped; sometimes revolute; oblique and running across entire fruit, oblique and with a gap at center of fruit, or irregular; sometimes with undulate to dentate margins), rugose, wrinkled, or raised reticulate; rarely, transversely grooved; not exfoliating; without cracks. Mesocarp thin; surface not veined; 1- or 2-layered; without balsamic vesicles; without fibers; solid or with spongy layer over solid layer; coriaceous or chartaceous. Endocarp dull; monochrome; brown to dark brown or white; smooth; septate or nonseptate; with septa thicker than paper, firm (up to 5 mm thick); with septa eglandular; ligneous or chartaceous; not exfoliating or exfoliating in part; remaining fused to mesocarp and epicarp. Seeds 1–16; length transverse to fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; 1–30 mm long; of 1 length only; flattened or thick; curved or triangular. Aril present or absent; fleshy or dry; when fleshy annular; crenate to fimbriate; covering less than 1/2 of seed; when dry rim-aril; crenate to entire; covering less than 1/2 of seed; with tongues (or flap-like) on lips of 2-lipped rim-aril; with 1 tongue or flap on 1 lip of 2-lipped rim-aril; orange or tan.

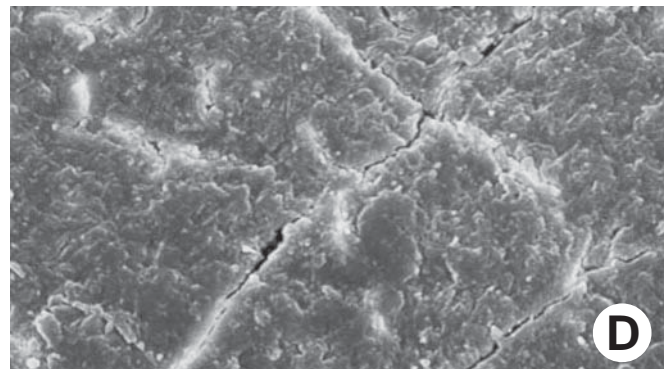
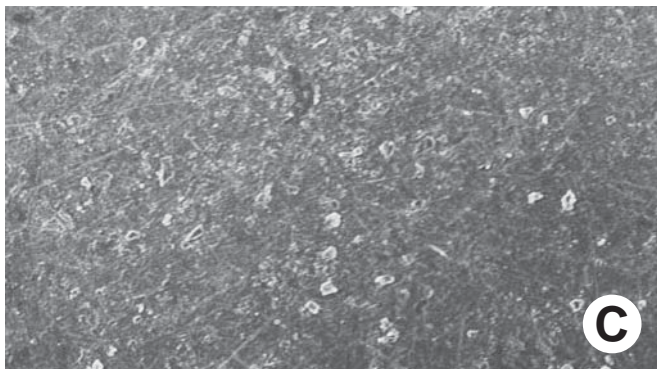
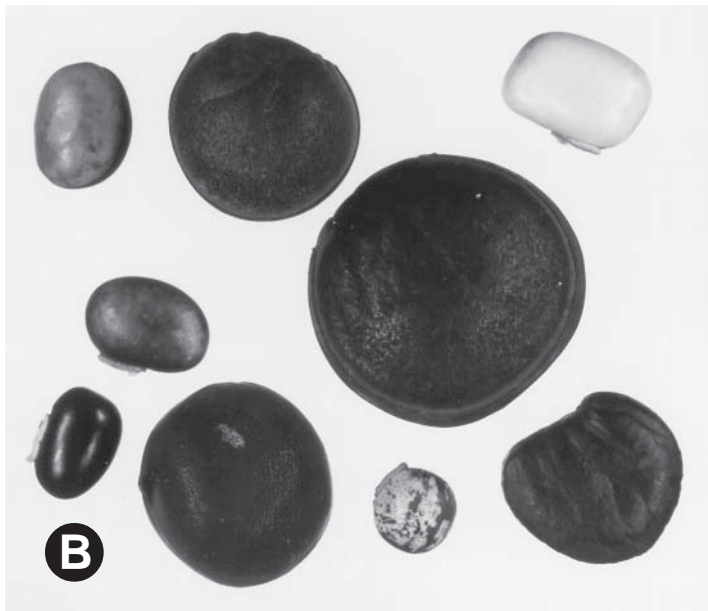
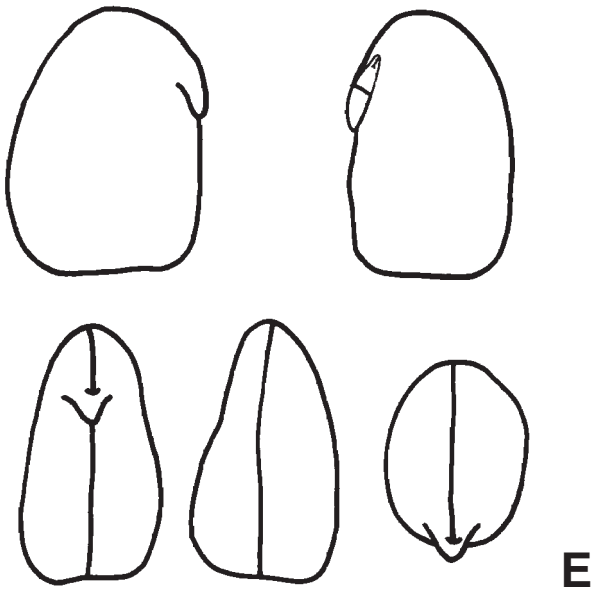
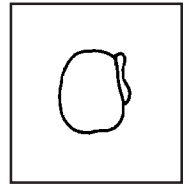
Seed $10\text{--}37 \times 7\text{--}36 \times 3\text{--}17.5$ mm; not overgrown; not angular; symmetrical or asymmetrical; circular, elliptic, oblong, ovate, or reniform; terete or compressed; with surface smooth or ridged (from literature); without visible radicle and cotyledon lobes; without umbo on seed faces. Testa not adhering to endocarp; dull; not modified by a bloom; colored; monochrome, mottled, or streaked; with frequent mottles; with frequent streaks; black, brown (dark, reddish, or orangish), orange (pale), tan, white, or purple (blackish); with black, tan, or orange overlay; glabrous; smooth or not smooth (rarely); with elevated features; rugose or rugose and wrinkled; osseous or coriaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum visible or partially concealed; concealed by funicular remnant; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 6–90 mm long; with straight (around 3/4 of seed circumference) or curved outline; elliptic or linear; marginal according to radicle tip; flush; not within corona, halo, or rim or within rim. Hilum rim color of testa. Lens not discernible or discernible; less than 0.5 mm to equal to or greater than

0.5 mm in length; 1 mm long; with margins straight or curved; linear or punctiform; not in groove of raphe; confluent with or adjacent to hilum; 1 mm from hilum; recessed; same color as testa; within rim or not within corona, halo, or rim. Lens rim color of testa. Endosperm absent. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing radicle; notched at radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; pale tan to brown; inner face flat; glabrous around base of radicle. Embryonic axis oblique; oblique or perpendicular to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; triangular; lobe tip curved; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary to moderately developed; glabrous.

Distribution: Pantropics and pansubtropics.

Notes: *Mucuna* has been monographed for various parts of Asia and the Pacific by Tateishi and Ohashi (1981) and Wilmot-Dear (1984, 1987, 1990, 1991, 1992). Some of the variation used for fruits is taken from those monographs. A single species, *M. sloanei* W. Fawcett & A.B. Rendle, has been reported for Argentina (Burkart 1970). *Mucuna* seeds can be divided into two broad groups: (1) large, flat, discoid seeds with the hilum extending three-fourths of the circumference and without an aril and (2) compressed, oblong-ovoid seeds with a very short hilum and a conspicuous rim-aril. The genus *Stizolobium* P. Browne was established for the species of the latter group. Traditionally it has been recognized at subgeneric rank as *Mucuna* subgen. *Stizolobium* (P. Browne) D. Prain (Verdcourt 1970c). Aminah et al. (1974) studied the irritating hairs of *Mucuna*. Various species from all over the world are well known as ocean drift seeds with the common names true sea-beans, burning-beans, and horse eye-beans (Gunn et al. 1976).

Mucuna: *M. pruriens* (C. Linnaeus) A.-P. de Candolle
(*C-E*), *M. spp.* (*A-B*). *A*, Fruits ($\times 0.5$); *B*, seeds ($\times 1.1$); *C-D*, testa ($\times 50$, $\times 1000$); *E*, embryos ($\times 2$).



Genus: *Butea* W. Roxburgh ex C.L. von Willdenow

Phylogenetic Number: 10.04.

Tribe: Phaseoleae.

Subtribe: Erythrinae.

Species Studied—Species in Genus: 2 spp.—2 spp.

Fruit a legume; unilocular; $10\text{--}18 \times 3\text{--}5.3 \times 0.4\text{--}0.6$ cm; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; asymmetrical; samaroid; when asymmetrical with both sutures unequally curved; not inflated; flattened; without beak; rounded to truncate at apex; apex oblique with longitudinal axis of fruit; tapered to rounded at base; base oblique with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous and leathery; seed chambers externally visible. Fruit margin not constricted; without sulcus; embellished; with thickened sutural areas (especially dorsally) or wing. Fruit wing 1; $30\text{--}53$ mm wide (and $90\text{--}110$ mm long); samaroid; basal. Fruit nonstipitate. Fruit indehiscent. Replum invisible. Epicarp dull; monochrome; tan; pubescent and indurate; with 1 type of pubescence; pilose to tomentose; with pubescence golden; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; not smooth; reticulately veined; not tuberculate; exfoliating in part; without cracks. Mesocarp thin; surface not veined; 3-layered; without balsamic vesicles; without fibers; with solid layer over spongy layer over solid layer; coriaceous. Endocarp dull; mottled; tan; with mottling (dark and fine); with brown overlay; smooth; nonseptate; chartaceous; exfoliating in part; remaining fused to mesocarp and epicarp; entire. Seed 1; length parallel with or oblique to fruit length. Funiculus measured; 4 mm long; thick; straight. Aril absent.

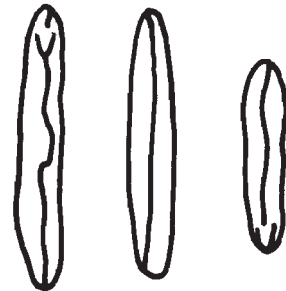
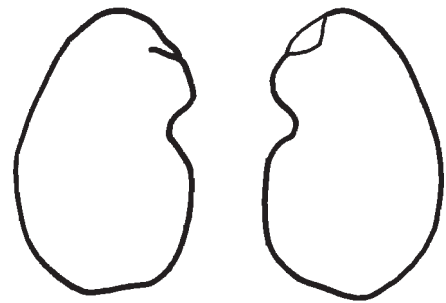
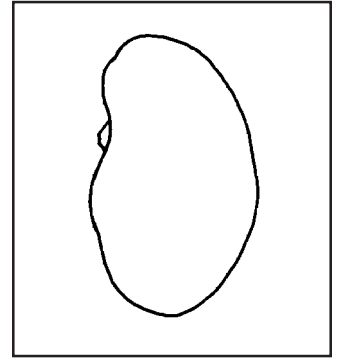
Seed $24\text{--}38 \times 19\text{--}27 \times 5\text{--}6$ mm; not overgrown; not angular; asymmetrical; irregularly reniform; flattened; with surface wrinkled; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; dull; not modified by a bloom; colored; mottled; with frequent mottles; reddish brown; with brown (dark) overlay; glabrous; not smooth; with elevated features; wrinkled or wrinkled and warty; chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe from hilum to near base of seed and terminating; not bifurcating; color

of testa; raised. Hilum visible; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; $1.5\text{--}2.5$ mm long; with curved outline; elliptic; marginal according to radicle tip; recessed; within halo. Hilum halo color darker than testa. Lens not discernible. Endosperm absent. Cotyledons not smooth; wrinkled; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180° degrees from base of radicle; similar at apex; partially concealing radicle; notched at radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; yellow; inner face flat; glabrous around base of radicle. Embryonic axis right angled or oblique; perpendicular or oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; linear; lobe tip straight; deflexed and parallel to cotyledon width or oblique to cotyledons; centered between cotyledons; less than $1/2$ length of cotyledons. Plumule rudimentary; glabrous.

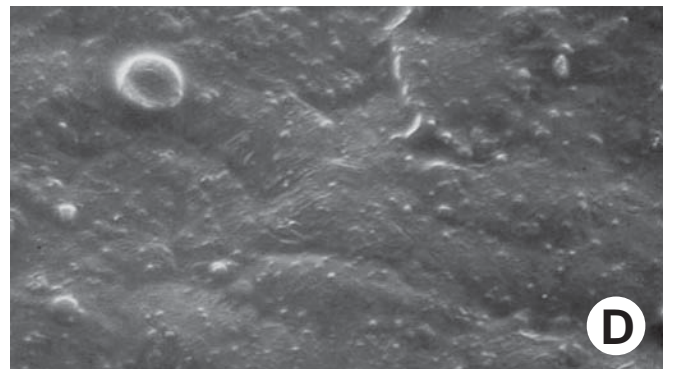
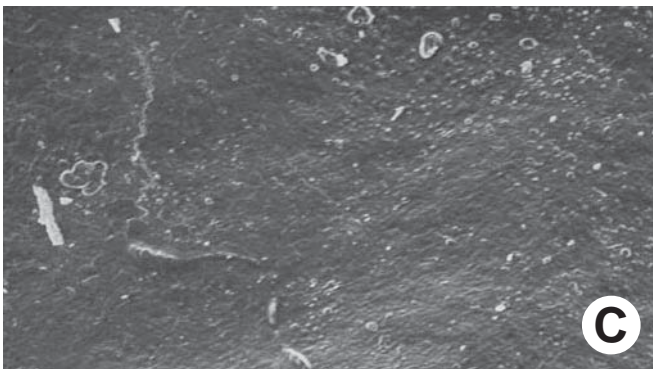
Distribution: India.

Notes: *Butea* was revised by Sanjappa (1987), who recognized two species, not the four species of Lackey (1981b). Ridder-Numan (1995) and Ridder-Numan and Ham (1997) considered this genus to be closely related to *Meizotropis* (10.06) and *Spatholobius* (10.05) and to *Kunstleria* in Millettieae (7).

Butea: *B. monosperma* (J.B.A.P.M. de Lamarck) P.H.W. Taubert (C–E), *B. spp.* (A–B). A, Fruits ($\times 0.4$); B, seeds ($\times 1.2$); C–D, testa ($\times 50$, $\times 1000$); E, embryos ($\times 1$).



E



Genus: *Spatholobus* J.C. Hasskarl

Phylogenetic Number: 10.05.

Tribe: Phaseoleae.

Subtribe: Erythrinae.

Species Studied—Species in Genus: 9 spp.—15 spp.

Fruit a legume; unilocular; $4\text{--}15 \times 1.3\text{--}4.5 \times 0.4\text{--}0.7$ cm; with deciduous calyx; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; asymmetrical; samaroid; when asymmetrical with both sutures unequally curved; not inflated; flattened; without beak; rounded at apex; apex aligned or oblique with longitudinal axis of fruit; rounded at base; base oblique with longitudinal axis of fruit; with the apex and base uniform in texture; leathery and chartaceous; seed chambers externally visible. Fruit margin not constricted; without sulcus; embellished; with thickened sutural areas (especially dorsally) or wing. Fruit wing 1; 13–45 mm wide (and 80–105 mm long); samaroid; basal. Fruit substipitate to stipitate; with the stipe up to 6 mm long. Fruit indehiscent. Epicarp dull; monochrome; brown or tan; glabrous to pubescent but soon deciduous; with 1 type of pubescence; pilose; with pubescence golden to brown; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; not smooth; with elevated features; transversely veined relative to fruit length, reticulately veined, or irregularly veined; not tuberculate; sometimes dotted; not exfoliating; without cracks. Mesocarp present (on seed chamber); thin; surface not veined; 1- or 2-layered; without balsamic vesicles; with or without fibers; solid; with fibers embedded in mealy tissue over solid layer; with vitreous layer over solid layer; coriaceous or chartaceous. Endocarp dull; monochrome or mottled; brown or tan; with mottling over seed chambers; with brown overlay (darker near margins of seed chamber); fibrous; nonseptate; coriaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seed 1; length parallel with fruit length. Funiculus measured; 1 mm long; flattened; triangular. Aril absent.

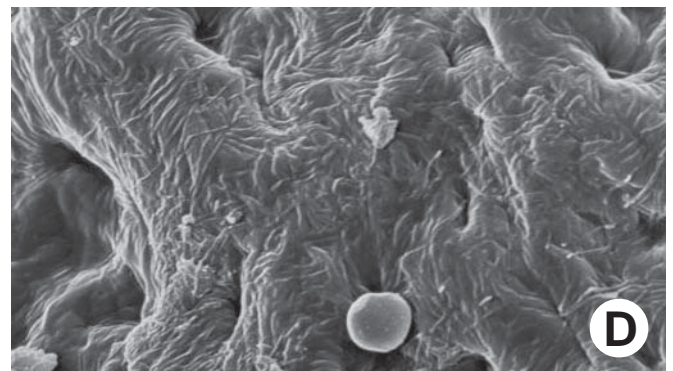
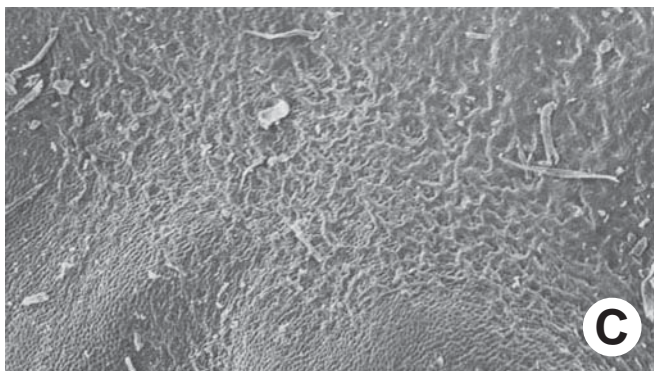
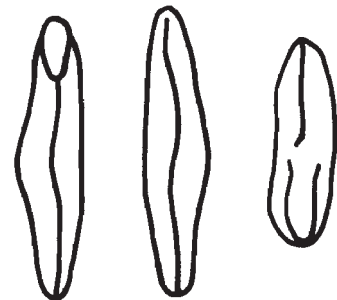
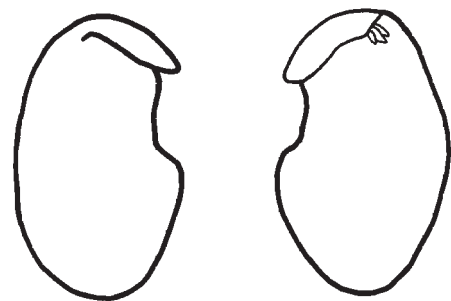
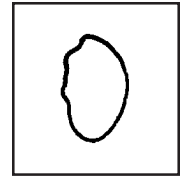
Seed $18.6\text{--}32 \times 11\text{--}23 \times 4\text{--}6.7$ mm; not overgrown; not angular; asymmetrical; variously irregular; flattened; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; dull; not

modified by a bloom; colored; monochrome; dark brown; glabrous; smooth or not smooth; with elevated features; wrinkled; chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe from hilum to near base of seed and terminating; not bifurcating; color of or darker than testa; black; raised. Hilum visible or partially concealed; concealed by funicular remnant; with or without faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 2.5–4.6 mm long; with curved outline; elliptic; marginal according to radicle tip; recessed; within rim. Hilum rim color of testa. Lens not discernible. Endosperm absent. Cotyledons not smooth; wrinkled; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin not entire 180 degrees from base of radicle; notched; similar at apex; partially concealing radicle; entire over radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; tan; inner face flat; glabrous around base of radicle. Embryonic axis oblique; oblique to length of seed; with a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; linear; lobe tip straight; deflexed and parallel to cotyledon width or oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule moderately developed; glabrous.

Distribution: Tropical Asia.

Notes: Ridder-Numan and Wiriadinata (1985) monographed *Spatholobus*, and Ridder-Numan (1992) added a new species and made some other revisions. Using cladistic methodology, Ridder-Numan (1996) presented an extensive analysis of its biogeography. Ridder-Numan (1995) and Ridder-Numan and Ham (1997) proposed that this genus was closely related to *Butea* (10.04) and *Meizotropis* (10.06) and to *Kunstleria* in Millettieae. They considered *Spatholobus* to be intermediate in its characteristics between Phaseoleae and Millettieae and suggested that its position was either basal in Phaseoleae or in the transition zone between the two tribes.

Spatholobus: *S. suberectus* D.B. Dunn (C–E), *S. spp.* (A–B). A, Fruits ($\times 0.6$); B, seeds ($\times 1.6$); C–D, testa ($\times 50$, $\times 1000$); E, embryos ($\times 2$).



Genus: *Meizotropis* J.O. Voigt

Phylogenetic Number: 10.06.

Tribe: Phaseoleae.

Subtribe: Erythrinae.

Species Studied—Species in Genus: 2 spp.—2 spp.

Fruit a legume; unilocular; $5-9 \times 2-4.3 \times$ up to 0.8 cm; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; asymmetrical; irregular or samaroid; when asymmetrical with both sutures unequally curved; not inflated; flattened; without beak; rounded at apex; apex oblique with longitudinal axis of fruit; rounded to truncate at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous and leathery; seed chambers externally visible. Fruit margin not constricted; without sulcus; embellished; with thickened sutural areas (especially dorsally) or wing. Fruit wing 1; 28–35 mm wide (and 30–60 mm long); samaroid; basal. Fruit stipitate (from literature); with the stipe 5–6 mm long (from literature). Fruit apparently indehiscent. Replum invisible. Epicarp dull; monochrome; brown; pubescent and indurate or pubescent but soon deciduous (from literature); with 1 type of pubescence; velutinous; with pubescence white; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; not smooth; with elevated features; veined or not veined; irregularly veined; not tuberculate; knobbed; not exfoliating; with or without cracks; cracking irregular. Mesocarp thin; surface not veined; 2-layered; without balsamic vesicles; without fibers; with spongy layer over solid layer; coriaceous. Endocarp dull; monochrome or mottled; brown or tan; with mottling over seed chambers; with brown overlay; smooth; chartaceous; exfoliating in part; remaining fused to mesocarp and epicarp. Seed 1 (1–2 in literature); length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; 2 mm long; of 1 length only; flattened; straight. Aril dry; 2-lipped rim-aril; entire; covering less than 1/2 of seed; without tongue (or flap-like) on lips of 2-lipped rim-aril; tan.

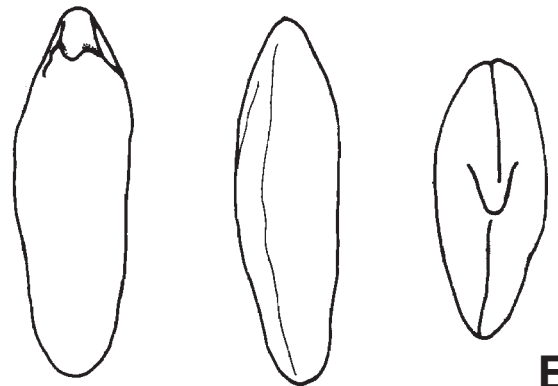
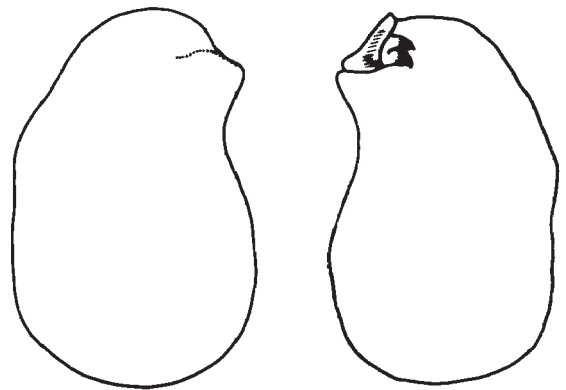
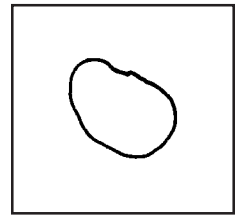
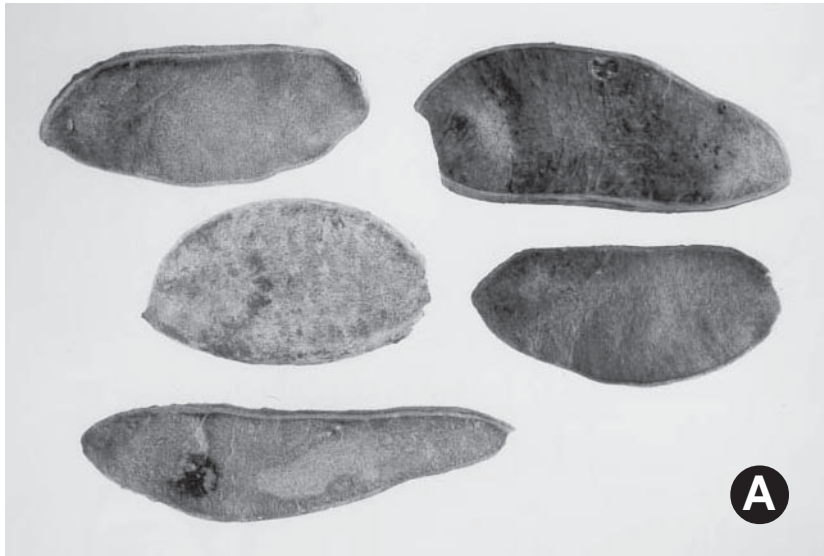
Seed $19.5 (17-22 \text{ from literature}) \times 16.4 (10-17 \text{ from literature}) \times 7 \text{ mm}$; not overgrown; not angular; asymmetrical; reniform; flattened; with surface smooth; without visible radicle and cotyledon lobes; without

hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; dull; not modified by a bloom; colored; monochrome; dark brown; glabrous; smooth or not smooth; with elevated features; wrinkled; chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe from hilum through lens and base of seed to point opposite hilum; not bifurcating; color of testa; raised. Hilum visible; without faboid split; larger than punctiform; 1.8 mm long; with curved outline; elliptic; marginal according to radicle tip; recessed; not within corona, halo, or rim. Lens discernible; less than 0.5 mm in length; with margins straight; linear; not in groove of raphe; confluent with hilum; recessed; same color as testa; within rim. Lens rim color of testa. Endosperm absent. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing radicle; split over radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; orange; inner face flat; glabrous around base of radicle. Embryonic axis oblique; perpendicular to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; linear; lobe tip straight; deflexed and parallel to cotyledon width; centered between cotyledons; less than 1/2 length of cotyledons. Plumule well developed.

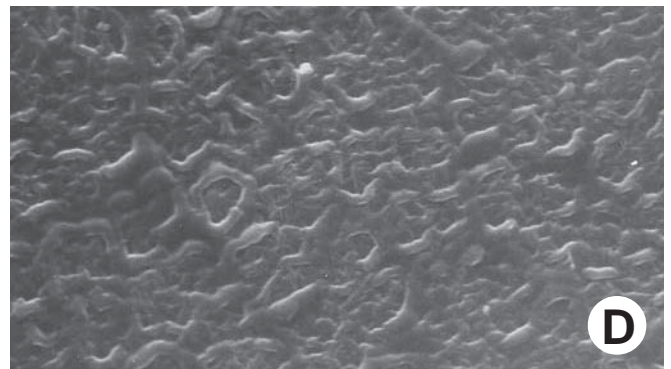
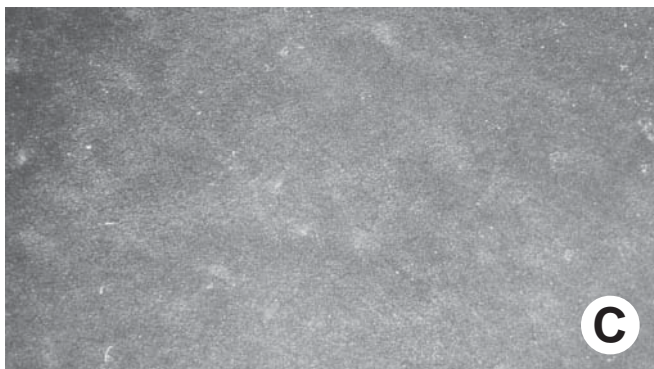
Distribution: India to Burma.

Notes: Sanjappa (1987) monographed the genus, which was not recognized by Lackey (1981b). It was inserted in phylogenetic order following Polhill (1994b). Ridder-Numan (1995) and Ridder-Numan and Ham (1997) considered this genus to be closely related to *Butea* (10.04) and *Spatholobius* (10.05) and to *Kunstleria* in Millettieae (7).

Meizotropis: *M. buteiformis* J.O. Voigt (B–E), *M. spp.* (A). A, Fruits ($\times 0.7$); B, seed ($\times 4.4$); C–D, testa ($\times 50$, $\times 1000$); E, embryos ($\times 3$).



E



Genus: *Apios* P.C. Fabricius

Phylogenetic Number: 10.07.

Tribe: Phaseoleae.

Subtribe: Erythrinae.

Species Studied—Species in Genus: 3 spp.—5 spp.

Fruit a legume; unilocular; $5.8\text{--}14.5 \times 0.6\text{--}0.8 \times 0.4\text{--}0.6$ cm; with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight to slightly curved; not plicate; not twisted; symmetrical to asymmetrical; linear (or nearly so) or moniliform (slightly); when asymmetrical with both sutures parallelly curved; not inflated; terete; without or with beak; straight or coiled; with solid beak the same color and texture as fruit; long tapered at apex to tapered at apex; apex aligned to oblique (slightly) with longitudinal axis of fruit; long tapered or tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; chartaceous to coriaceous; seed chambers externally visible or invisible; with the raised seed chambers not torulose. Fruit margin not constricted; without sulcus; embellished; with thickened sutural areas. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscent; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome or multicolored; mottled; brown, green, or tan; with brown (dark) overlay; with mottling over seed chambers; glabrous or pubescent and indurate; with hairs appressed; with 1 type of pubescence; with pubescence golden; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; not smooth; with elevated features (sometimes); irregularly veined; not tuberculate; lenticular; not exfoliating; without cracks. Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; solid; coriaceous. Endocarp dull; monochrome or mottled; white; with mottling over seed chambers; with brown overlay; smooth; septate; with septa thin (tissue paper-like), flexible; with septa eglandular; chartaceous; exfoliating in part; remaining fused to mesocarp and epicarp; entire. Seeds 3–18; length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; $0.5\text{--}1.5$ mm long; of 1 length only; flattened; curved or triangular. Aril dry; tongue-aril or 2-lipped rim-aril; entire; covering less than $1/2$ of seed; with tongues (or flap-

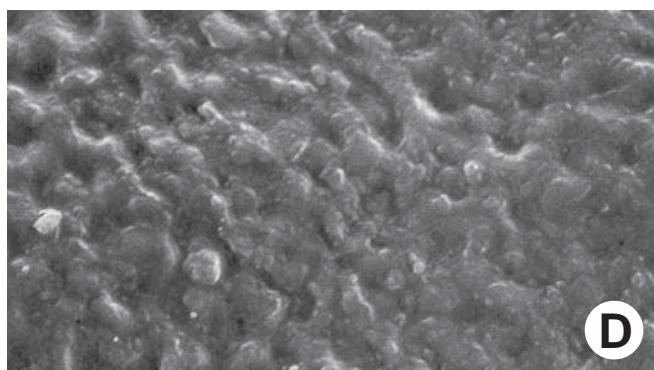
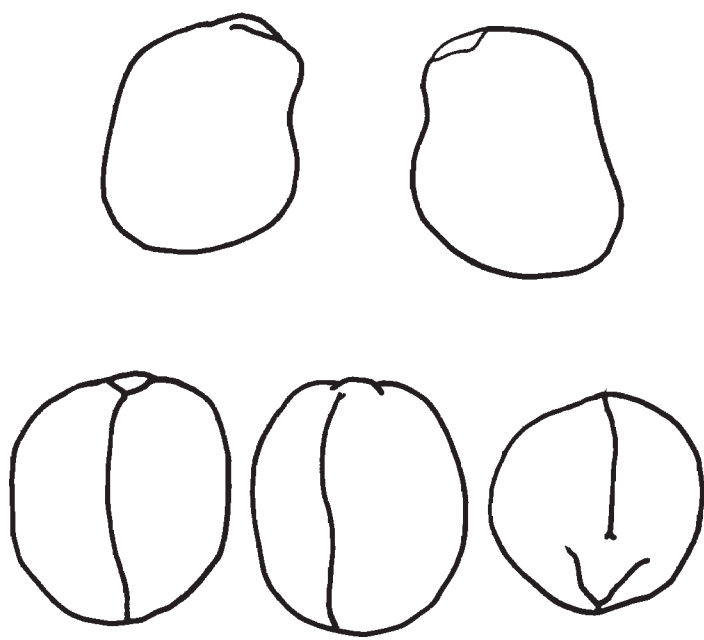
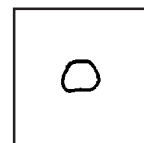
like) on lips of 2-lipped rim-aril; with 1 tongue or flap on 1 lip of 2-lipped rim-aril or 2 tongues or flaps, 1 on each lip of 2-lipped rim-aril; brown or brown and tan.

Seed $6.4\text{--}8.3 \times 4.5\text{--}5.4 \times 2.8\text{--}6$ mm; not overgrown; angular or not angular; symmetrical or asymmetrical; rectangular to ovate to obovate or reniform; terete or compressed; with surface smooth; without or with visible radicle and cotyledon lobes; without external groove between radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; dull; not modified by a bloom; colored; monochrome; brown to reddish brown; glabrous; smooth; chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe visible or not visible; from hilum through lens to base of seed and terminating, from hilum to near base of seed and terminating, or from hilum through lens and base of seed to point opposite hilum; not bifurcating; color of testa; raised or raised and recessed. Hilum visible to partially concealed to fully concealed; concealed by aril; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; $1.2\text{--}1.5$ mm long; with curved outline; elliptic; apical according to radicle tip but marginal according to seed length or marginal according to radicle tip; recessed; within rim or not within corona, halo, or rim. Hilum rim color darker than testa. Lens discernible or not discernible; equal to or greater than 0.5 mm in length; up to 1.2 mm long; with margins straight; linear; not in groove or in groove of raphe; confluent with hilum; recessed or mounded; same color as testa; within rim. Lens rim color of testa. Endosperm absent. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing or not concealing radicle; split over radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; yellow or tan; inner face flat or concave; glabrous around base of radicle. Embryonic axis nearly straight or oblique; oblique or perpendicular to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; triangular or linear; lobe tip straight or curved; deflexed and parallel to cotyledon length, deflexed and parallel to cotyledon width, or oblique to cotyledons; centered between cotyledons; less than $1/2$ length of cotyledons. Plumule rudimentary or moderately developed; glabrous.

Distribution: North America and Asia.

Notes: Lackey (1981b) commented that this genus is very close to *Cochlianthus* (10.08) and that the two genera are possibly congeneric. Our fruit and seed data do not support Lackey's conclusions. Woods (1988) revised both *Apios* and *Cochlianthus*, and his distributions and species counts were used. He concluded that the two genera are separate but closely related. *Apios americana* produces sweet, starchy tubers, which were eaten by North American native peoples (National Academy of Sciences 1979, Schery 1972). The tubers have a protein content of 17.5 percent.

Apios: *A. americana* F.C. Medikus (*A*, *C–E*), *A. spp.* (*B*).
A, Fruits ($\times 1.7$); *B*, seeds ($\times 4.8$); *C–D*, testa ($\times 50$,
 $\times 1000$); *E*, embryos ($\times 6$).



Genus: *Cochlianthus* G. Bentham

Phylogenetic Number: 10.08.

Tribe: Phaseoleae.

Subtribe: Erythrinae.

Species Studied—Species in Genus: 2 spp.—2 spp.

Fruit a legume; unilocular; $8.1 \times 1 \times 0.3$ cm; with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; symmetrical; slightly moniliform; not inflated; compressed; with beak; straight; with solid beak the same color and texture as fruit; short tapered at apex; apex oblique with longitudinal axis of fruit; tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous; seed chambers externally visible; with the raised seed chambers not torulose. Fruit margin slightly constricted along both margins; without sulcus; plain. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp pubescent and indurate; with 1 type of pubescence; very dense tomentose; with pubescence gray-brown or brown (dark); with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; not tuberculate. Mesocarp thin to trace; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; chartaceous. Endocarp dull; mottled; brown; with mottling (dark); with black overlay; fibrous; with hairs scattered over endocarp; septate; with septa thicker than paper, firm; with septa eglandular; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 6; length oblique to fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; 1.5 mm long; of 1 length only; flattened; triangular. Aril dry; 2-lipped rim-aril; entire; covering less than 1/2 of seed; without tongue (or flap-like) on lips of 2-lipped rim-aril; with 2 tongues or flaps, 1 on each lip of 2-lipped rim-aril; ivory.

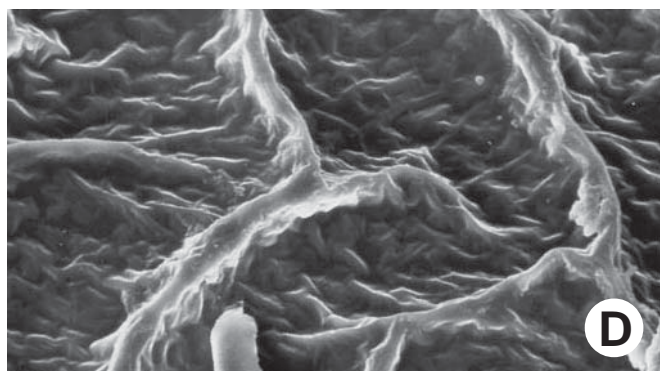
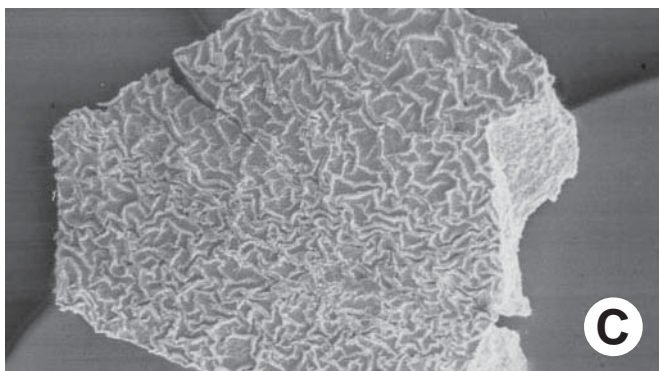
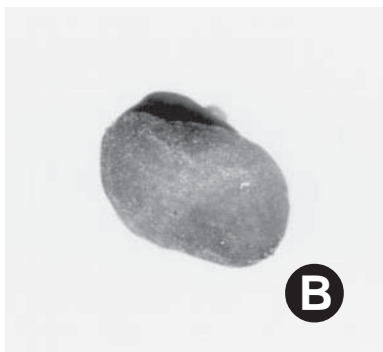
Seed $8.8 \times 7.6 \times 3.5$ mm; not overgrown; angular; asymmetrical; irregular; compressed; with surface smooth; without visible radicle and cotyledon lobes; with shallow hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; dull; not modified by a bloom; colored; monochrome; black; glabrous; smooth;

chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum partially concealed; concealed by aril; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 2 mm long; with curved outline; elliptic; apical according to radicle tip but marginal according to seed length; recessed; within halo. Hilum halo color lighter than testa. Lens discernible; equal to or greater than 0.5 mm in length; 1.5 mm long; with margins straight; linear; not in groove of raphe; confluent with hilum; flush; similar color as testa; lighter than testa; brown; not within corona, halo, or rim. Endosperm thin; covering entire embryo; adnate to testa. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing radicle; notched at radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; white; inner face flat; glabrous around base of radicle. Embryonic axis right angled; perpendicular to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; linear; lobe tip straight; with 90-degree turn; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Himalayas and southwestern China (Yunnan province).

Notes: Lackey (1981b) noted that *Cochlianthus* is “a very close relative of *Apios* [10.07], possibly congeneric.” Our fruit and seed data do not support Lackey’s conclusions. Woods (1988) revised both *Cochlianthus* and *Apios*, and his distributions and species counts were used. He concluded that the two genera are separate but closely related. One fruit and seed were studied, and the seed was immature—it did not have a developed embryo or cotyledons.

Cochlianthus: *C. gracilis* G. Bentham (A–D). A, Fruit ($\times 1.8$); B, seed ($\times 10.8$); C–D, testa ($\times 50$, $\times 1000$).



Genus: *Rhodopis* I. Urban

Phylogenetic Number: 10.09.

Tribe: Phaseoleae.

Subtribe: Erythrinae.

Species Studied—Species in Genus: 1 or 2 spp.—1 or 2 spp.

Fruit a legume; unilocular; $11\text{--}15 \times 1.2\text{--}1.7 \times 0.3\text{--}0.4$ cm; with deciduous calyx; without orifice formed by curving of fruit or fruit segments; straight or curved (slightly); not plicate; not twisted; asymmetrical or symmetrical; essentially linear; when asymmetrical with both sutures parallelly curved; not inflated; flattened; without beak; short tapered at apex; apex aligned with longitudinal axis of fruit; long tapered at base; base oblique with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous; seed chambers externally invisible. Fruit margin not constricted; without sulcus; plain. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves enrolling. Replum invisible. Epicarp dull; monochrome; dirty brown; pubescent but soon deciduous; with hairs appressed; with 1 type of pubescence; with pubescence brown; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; not smooth; with elevated features; faintly veined; irregularly veined; not tuberculate; wrinkled; not exfoliating; without cracks. Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; coriaceous. Endocarp dull; monochrome; brown or tan; smooth; with hairs scattered over endocarp; subseptate; with septa thin (tissue paper-like), flexible; with septa eglandular; chartaceous; exfoliating in part (between seed chambers); remaining fused to mesocarp and epicarp; entire. Seeds 11–18; length oblique to fruit length; touching or neither overlapping nor touching; in 1 series. Funiculus measured; 1.5–2 mm long; of 1 length only; flattened; slightly curved or triangular. Aril dry; 2-lipped rim-aril; fimbriate; covering less than 1/2 of seed; with tongues (or flap-like) on lips of 2-lipped rim-aril; with 1 tongue or flap on 1 lip of 2-lipped rim-aril; tan.

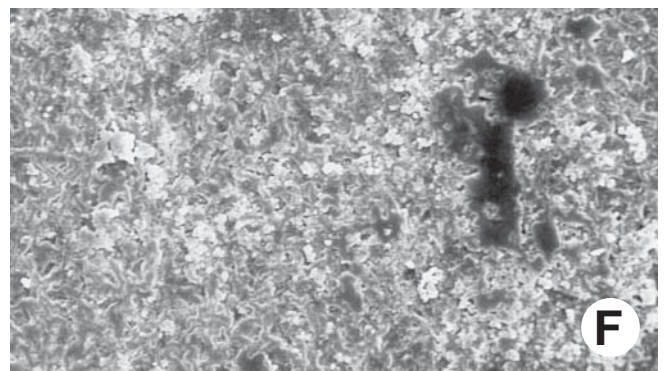
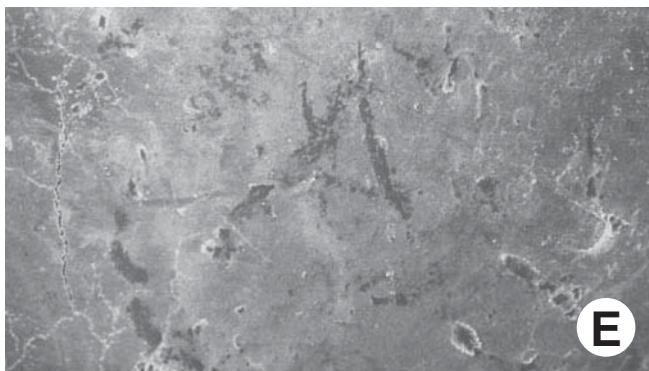
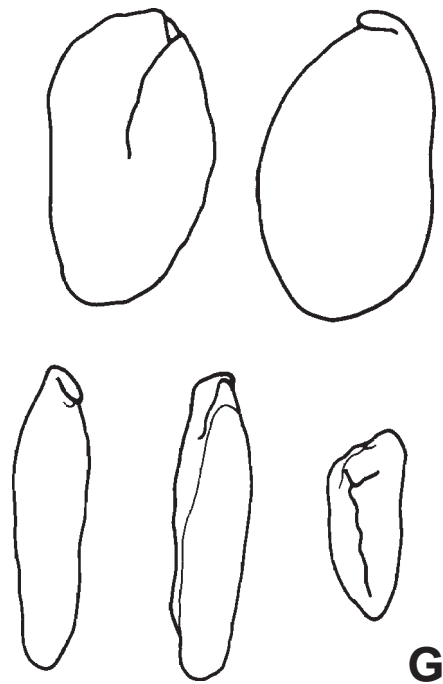
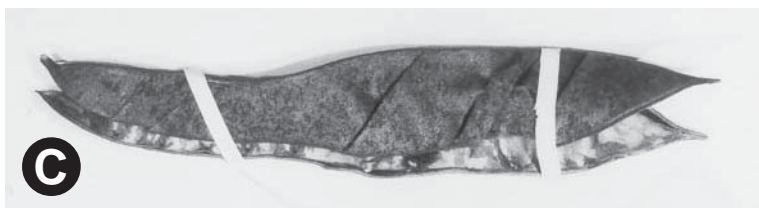
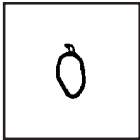
Seed $4 \times 3.5 \times 1.8$ mm; not overgrown; not angular; asymmetrical; irregular; compressed; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa

not adhering to endocarp; dull; not modified by a bloom; colored; monochrome; brown; glabrous; smooth; chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum visible; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 1.4 mm long; with curved outline; elliptic; apical according to radicle tip but marginal according to seed length; recessed; within rim. Hilum rim color darker than testa. Lens discernible; equal to or greater than 0.5 mm in length; 0.5 mm long; with margins straight; linear; not in groove of raphe; confluent with hilum; flush; similar color as testa; darker than testa; within halo. Lens halo color darker than testa. Endosperm absent. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing radicle; notched at radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; tan; inner face flat; glabrous around base of radicle. Embryonic axis right angled; perpendicular to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; linear; lobe tip curved; deflexed and parallel to cotyledon width; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

Distribution: West Indies.

Notes: Lackey (1981b) recognized one species in this genus, but is a species in Haiti, *Rhodopis planisiliqua* I. Urban, different from a species known only from the type locality in the Dominican Republic, *R. lowdenii* W.S. Judd? Our observations were made only from limited material of *R. lowdenii* and some immature fruits of *R. planisiliqua*. Thomas Zanoi (Jardín Botánico Nacional Dr. Rafael M. Moscoso (Dominican Republic)) supplied the loan of *R. lowdenii*. *Neorudolphia* (10.10) was recognized as a segregate of *Rhodopis* (Lackey 1981b); their fruits and seeds are similar.

Rhodopis: *R. lowdenii* W.S. Judd (A, B, G), *R. planisiliqua* (C. Linnaeus) I. Urban (C–F). A–C, fruits ($\times 0.4$, $\times 0.8$, $\times 0.8$); D, seeds ($\times 6$); E–F, testa ($\times 50$, $\times 1000$); G, embryos ($\times 4$).



Genus: *Neorudolphia* N.L. Britton

Phylogenetic Number: 10.10.

Tribe: Phaseoleae.

Subtribe: Erythrinae.

Species Studied—Species in Genus: 1 sp.—1 sp.

Fruit a legume; unilocular; $6\text{--}12 \times 1\text{--}1.7 \times 0.5$ cm; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; symmetrical; linear; not inflated; compressed; without beak; tapered at apex; apex aligned with longitudinal axis of fruit; tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous; seed chambers externally invisible. Fruit margin not constricted; without sulcus; plain. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome; brown; pubescent and indurate; with 1 type of pubescence; puberulent; with pubescence golden; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; straight; eglandular; without spines; smooth; not veined; not tuberculate; exfoliating in part; with cracks; cracking oblique to fruit length. Mesocarp thin; surface uniformly veined; 1-layered; without balsamic vesicles; solid; coriaceous. Endocarp dull; mottled; tan; with mottling over seed chambers; with brown overlay; smooth; septate; with septa thin (tissue paper-like), flexible; with septa eglandular; chartaceous; exfoliating in part; partially separating from mesocarp; entire. Seeds 11; length transverse to fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; 1–2 mm long; of 1 length only; flattened; straight or triangular. Aril dry; rim-aril and tongue-aril; entire; covering less than 1/2 of seed; brown.

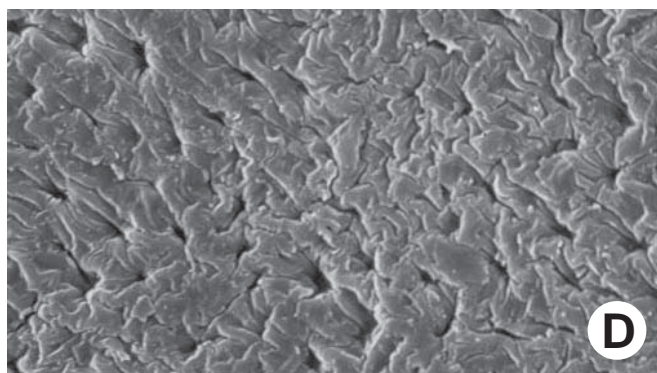
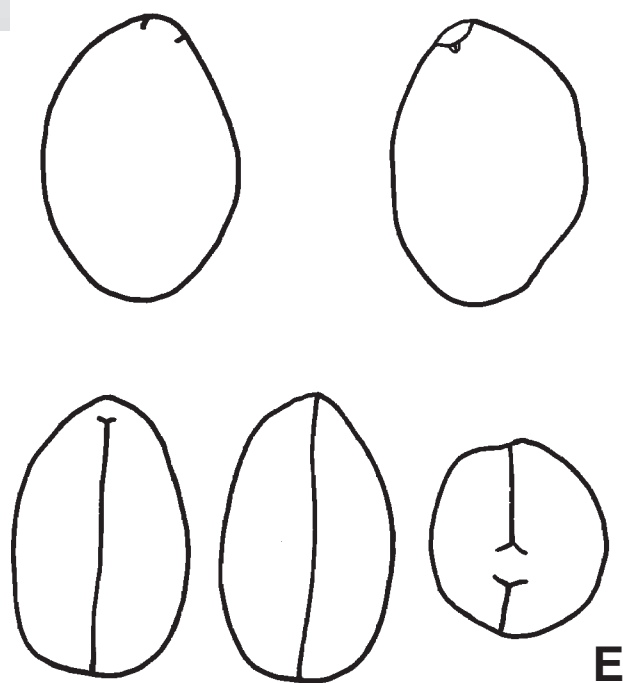
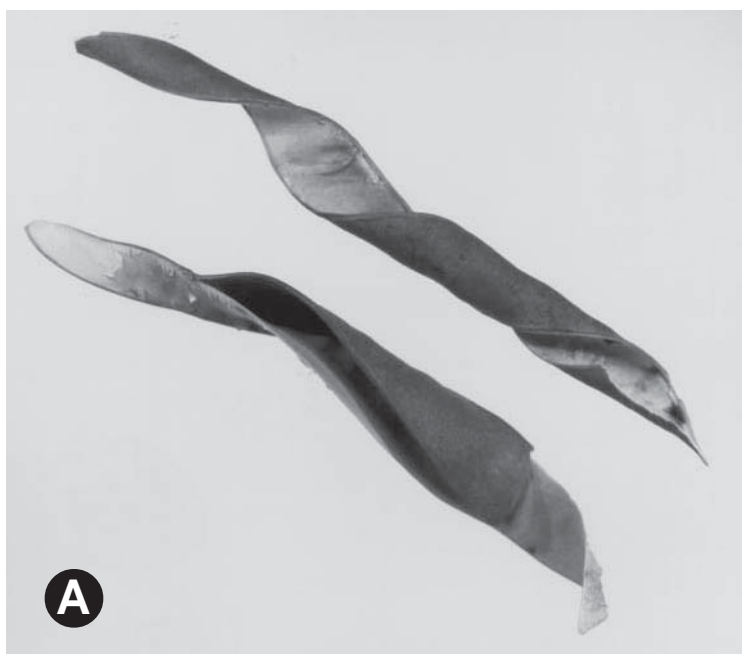
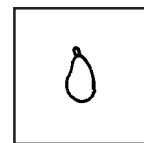
Seed $7\text{--}12 \times 4.5\text{--}7 \times 3.8\text{--}6.5$ mm; not overgrown; angular or not angular; symmetrical; elliptic; terete to quadrangular; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; dull; not modified by a bloom; colored; monochrome or mottled; with frequent mottles; reddish brown; with brown (dark) overlay; glabrous; smooth; chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe from hilum to near base of seed and terminating; not bifurcating; color of testa; raised. Hilum partially concealed;

concealed by aril; without faboid split; larger than punctiform; 1.4–2 mm long; with curved outline; elliptic; apical at apex of radicle tip; raised; within rim. Hilum rim color darker than testa. Lens not discernible. Endosperm absent. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing radicle; notched at radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; tan; inner face flat; glabrous around base of radicle. Embryonic axis straight; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; triangular; lobe tip straight; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

Distribution: West Indies.

Notes: Lackey (1981b) noted that *Neorudolphia* is a segregate genus of *Rhodopsis* (10.09). Their fruits and seeds are similar.

Neorudolphia: *N. volubilis* (C.L. von Willdenow) N.L. Britton (A–E). A, Fruits ($\times 1$); B, seeds ($\times 4.7$); C–D, testa ($\times 50$, $\times 1000$); E, embryos ($\times 5$).



Genus: *Ophrestia* H.M.L. Forbes

Phylogenetic Number: 10.11.

Tribe: Phaseoleae.

Subtribe: Ophrestiinae.

Species Studied—Species in Genus: 12 spp.—14 spp.

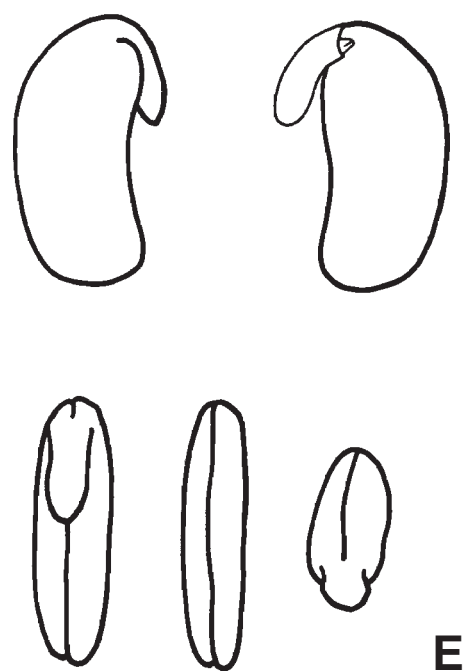
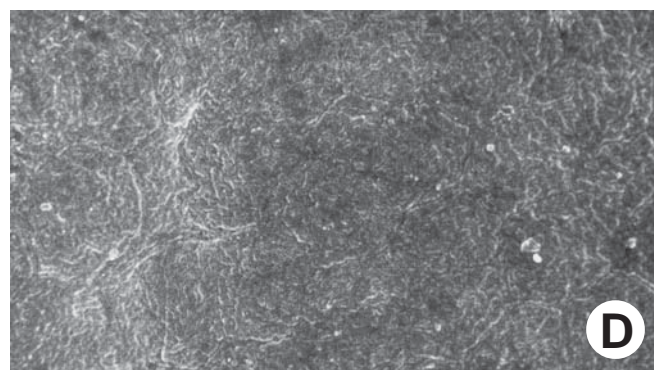
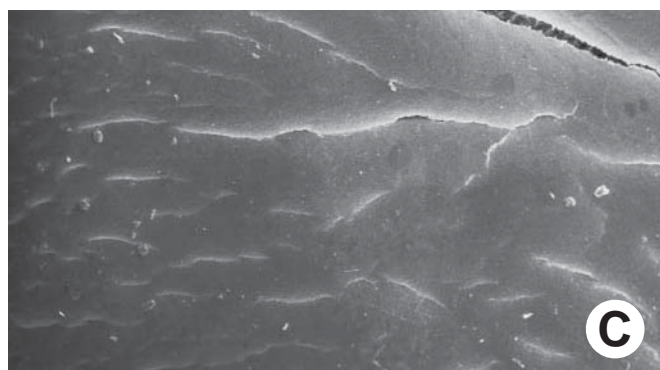
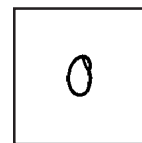
Fruit a legume; unilocular; $3\text{--}6.5 \times 0.6\text{--}1.1 \times 0.4$ cm; with persistent or deciduous calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; slightly asymmetrical; linear; when asymmetrical with both sutures nearly straight; not inflated; flattened; without beak; tapered or short tapered at apex; apex aligned with longitudinal axis of fruit; tapered or truncate at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous; seed chambers externally, barely visible or invisible. Fruit margin not constricted or constricted (slightly); constricted along both margins; without sulcus; plain or embellished; with thickened (slightly) sutural areas. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome; light brown; glabrous or pubescent and indurate; with 1 type of pubescence; tomentose; with pubescence golden; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; smooth or not smooth; with elevated features; not veined; not tuberculate; wrinkled; not exfoliating; without cracks. Mesocarp thin; 1-layered; without balsamic vesicles; without fibers; solid; coriaceous. Endocarp dull; monochrome; tan; smooth; subseptate; with septa thin (tissue paper-like), flexible; with septa eglandular; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 2–6; length parallel with or oblique to fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; up to 3 mm long; of 1 length only; flattened; triangular. Aril fleshy or dry; when fleshy hippocrepiform rim-aril; entire or crenate; covering less than 1/2 of seed; when dry rim-aril or hippocrepiform rim-aril; entire; covering less than 1/2 of seed; with tongues (or flap-like) on lips of 2-lipped rim-aril; with 1 tongue or flap on 1 lip of 2-lipped rim-aril; cream to tan.

Seed $5\text{--}11 \times 3.5\text{--}6.5 \times 1.8\text{--}3.5$ mm; not overgrown; not angular or angular; asymmetrical; reniform to elliptic or rectangular (nearly); compressed; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; glossy to dull; not modified by a bloom; colored; monochrome or mottled; with infrequent mottles; brown; with brown (lighter) overlay; glabrous; smooth; chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum partially concealed; concealed by aril; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 1–2.5 mm long; with curved outline; elliptic; apical according to radicle tip but marginal according to seed length; flush or recessed; within rim or halo or not within corona, halo, or rim. Hilum halo color darker than testa. Hilum rim color of testa. Lens discernible; less than 0.5 mm in length; with margins straight; linear; not in groove of raphe; confluent with hilum; flush; similar color as testa; darker than testa; not within corona, halo, or rim. Endosperm thin or trace; restricted to region of embryo or covering at least 1/2 of embryo, but not entire embryo; adnate to testa. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing radicle; entire over radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; white to tan to brown; inner face flat; glabrous around base of radicle. Embryonic axis straight; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; linear; lobe tip curved; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Africa and Asia.

Notes: Lackey (1981b) noted that some Asian species resemble *Cruddasia* (10.13) and some African species resemble *Pseudoeriosema* (10.12). Verdcourt (1997) described a new species from Zambia, *O. breviraemosoma* B. Verdcourt, and provided a key to the five *Ophrestia* species known from Zambia.

Ophrestia: *O. radicata* (A. Richard) B. Verdcourt (C–E), *O.* spp. (A–B). A, Fruits ($\times 1.2$); B, seeds ($\times 5$); C–D, testa ($\times 50$, $\times 1000$); E, embryos ($\times 6$).



Genus: *Pseudoeriosema* L. Hauman

Phylogenetic Number: 10.12.

Tribe: Phaseoleae.

Subtribe: Ophrestinae.

Species Studied—Species in Genus: 2 spp.—6 spp.

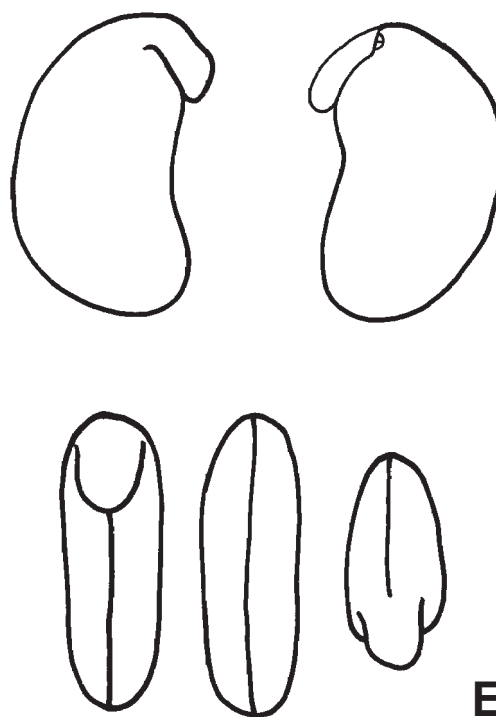
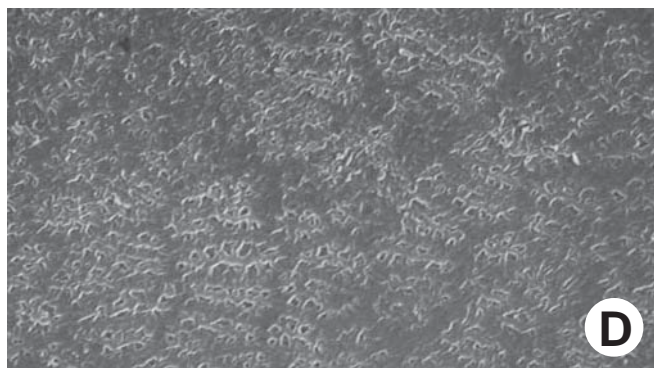
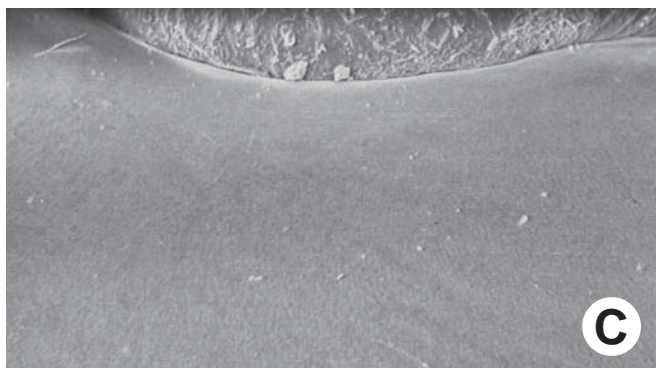
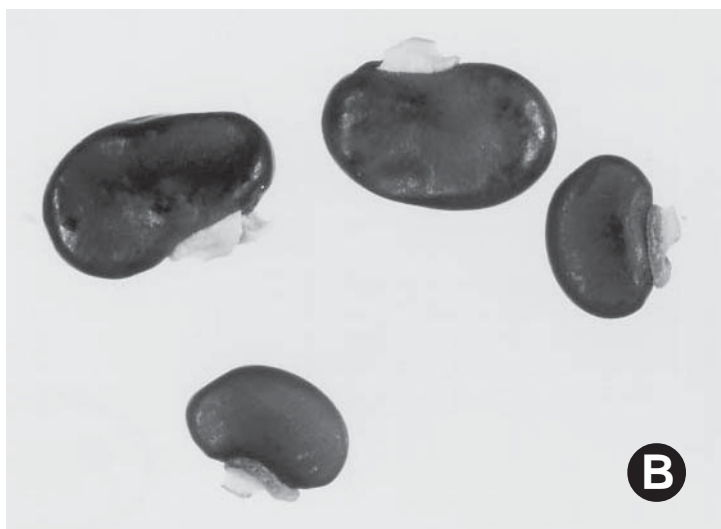
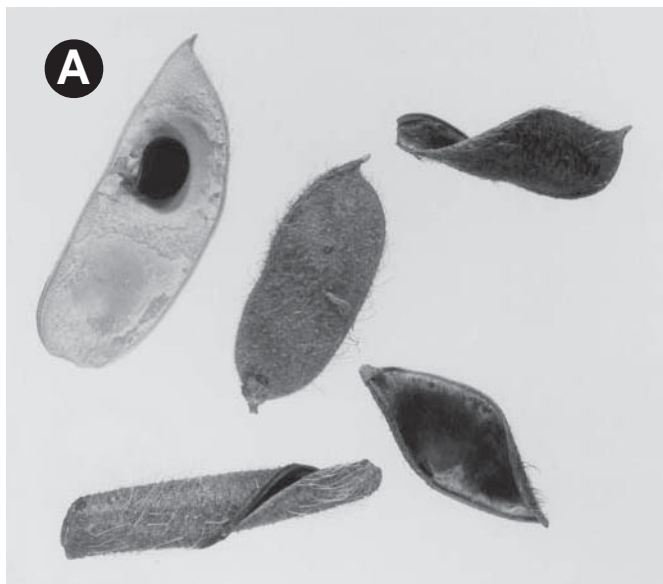
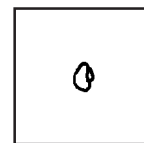
Fruit a legume; unilocular; $1.5-2 \times 0.6-0.7 \times 0.4$ cm; with persistent or deciduous calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; symmetrical to asymmetrical (slightly); elliptic or linear; when asymmetrical with both sutures parallelly curved or nearly straight; not inflated; flattened; without or with beak (short); declined; with solid beak the same color and texture as fruit; tapered or short tapered at apex; apex aligned with longitudinal axis of fruit; tapered at base to rounded at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous; seed chambers externally invisible. Fruit margin not constricted; without sulcus; plain. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscent; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome; tan to brown; pubescent and indurate; with 1 type of pubescence; long sericeous; with pubescence golden to brown; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; smooth or not smooth; with elevated features; not veined; not tuberculate; papillose; not exfoliating; without cracks. Mesocarp thin; 1-layered; without balsamic vesicles; without fibers; solid; coriaceous. Endocarp dull; monochrome or bichrome; tan to brown or tan and brown; smooth; subseptate; with septa thin (tissue paper-like), flexible; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 1–2; length parallel with to oblique to fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; up to 1 mm long; of 1 length only; flattened; triangular. Aril dry; hippocrepiform rim-aril; entire; without tongue (or flap-like) on lips of 2-lipped rim-aril; with 1 tongue or flap on 1 lip of 2-lipped rim-aril; tan.

Seed $4-8 \times 3-5 \times 2-3$ mm; not overgrown; not angular; asymmetrical; reniform to elliptic; compressed; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces.

Testa not adhering to endocarp; slightly glossy; not modified by a bloom; colored; monochrome; reddish brown to brown; glabrous; smooth; chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum partially concealed; concealed by aril; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 1.5–2.5 mm long; with curved outline; elliptic; apical according to radicle tip but marginal according to seed length or marginal according to radicle tip; flush to recessed; not within corona, halo, or rim or within halo. Hilum halo color darker than testa. Lens discernible; equal to or greater than 0.5 mm in length; up to 1 mm long; with margins straight; linear; not in groove of raphe; confluent with hilum; flush; similar color as testa; darker than testa; not within corona, halo, or rim. Endosperm thin; covering at least 1/2 of embryo but not entire embryo; adnate to testa. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing radicle; split over radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; white to yellow; inner face flat; glabrous around base of radicle. Embryonic axis straight; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; linear; lobe tip curved; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Tropical Africa.

Pseudoeriosema: *P. andongense* (F.M.J. Welwitsch ex J.G. Baker) L. Hauman (*C–E*), *P. spp.* (*A–B*). *A*, Fruits ($\times 2.5$); *B*, seeds ($\times 6.1$); *C–D*, testa ($\times 50$, $\times 1000$); *E*, embryos ($\times 8$).



Genus: *Cruddasia* D. Prain

Phylogenetic Number: 10.13.

Tribe: Phaseoleae.

Subtribe: Ophrestinae.

Species Studied—Species in Genus: 1 sp.—4 sp.

Fruit a legume; unilocular; $30\text{--}40 \times 8.5\text{--}9.5 \times 0.4$ cm; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; slightly asymmetrical; linear; when asymmetrical with both sutures nearly straight; not inflated; flattened; without beak; short tapered at apex; apex aligned with longitudinal axis of fruit; short tapered to rounded at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; chartaceous; seed chambers externally, barely visible; with the raised seed chambers not torulose. Fruit margin not constricted; without sulcus; plain. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome; brown; pubescent and indurate; with 1 type of pubescence; velutinous; with pubescence white; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; smooth; not veined; not tuberculate; not exfoliating; without cracks. Mesocarp thin; 1-layered; without balsamic vesicles; without fibers; solid; coriaceous. Endocarp glossy; monochrome; tan; smooth; subseptate; with septa thin (tissue paper-like), flexible; with septa eglandular; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp. Seeds 3–5; length oblique to fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; 2 mm long; of 1 length only; flattened; triangular. Aril fleshy; hippocrepiform rim-aril; entire; covering less than 1/2 of seed; with tongues (or flap-like) on lips of 2-lipped rim-aril; with 1 tongue or flap on 1 lip of 2-lipped rim-aril; tan.

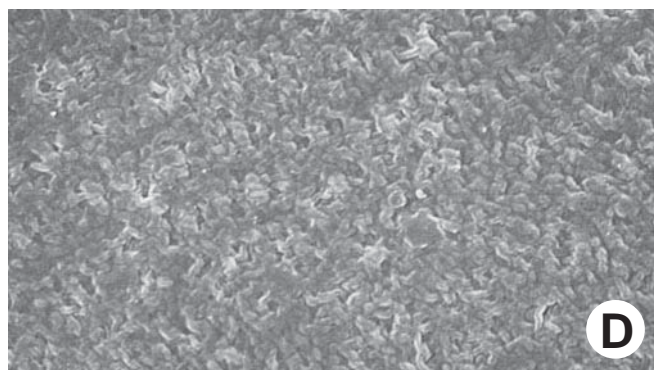
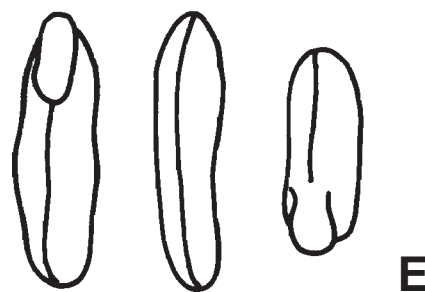
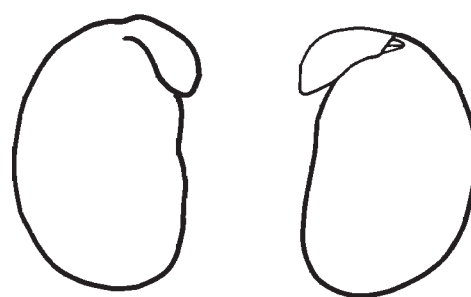
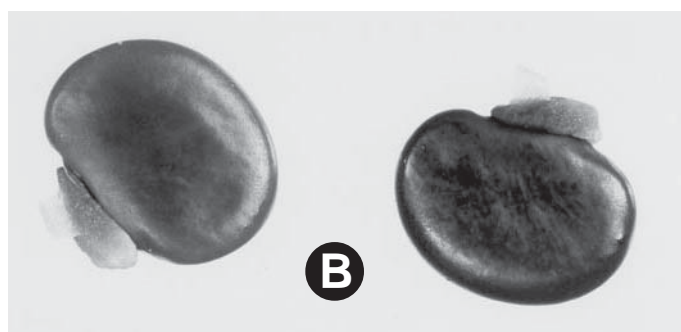
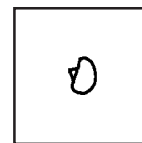
Seed $6\text{--}8 \times 4\text{--}5.5 \times 2\text{--}3.5$ mm; not overgrown; not angular; asymmetrical; reniform; compressed; with surface smooth; with (barely) or without visible radicle and cotyledon lobes; without external groove between radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; glossy; not modified by a bloom; colored; monochrome; brown; glabrous; smooth; chartaceous.

Fracture lines absent. Rim absent. Raphe not visible. Hilum partially concealed; concealed by aril; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 2.5 mm long; with curved outline; elliptic; apical according to radicle tip but marginal according to seed length; recessed; not within corona, halo, or rim or within halo. Hilum halo color darker than testa. Lens discernible; less than 0.5 mm or equal to or greater than 0.5 mm in length; 0.5–0.8 mm long; with margins straight; linear; not in groove of raphe; confluent with hilum; flush; similar color as testa; darker than testa; not within corona, halo, or rim. Endosperm thin; covering at least 1/2 of embryo, but not entire embryo; adnate to testa. Cotyledons not smooth; dimpled once; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing radicle; split over radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; yellowish green; inner face flat; glabrous around base of radicle. Embryonic axis oblique; oblique to perpendicular to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; bulbous; lobe tip curved; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

Distribution: India, Southeast Asia, and southern China.

Notes: Niyomdham (1992) described a new species of *Cruddasia*, *C. craibii* C. Niyomdham, and transferred two other species into the genus, *C. laotica* (F. Gagnepain) C. Niyomdham and *C. pinnata* (E.D. Merrill) C. Niyomdham. His species count and distribution were used. Only fruits from a single specimen were studied.

Cruddasia: *C. insignis* D. Prain (A–E). A, Fruits ($\times 3$); B, seeds ($\times 7$); C–D, testa ($\times 50$, $\times 1000$); E, embryos ($\times 6$).



Genus: *Centrosema* (A.-P. de Candolle) G. Benth

Phylogenetic Number: 10.14.

Tribe: Phaseoleae.

Subtribe: Clitoriinae.

Species Studied—Species in Genus: 10 spp.—45 spp.

Fruit a legume; unilocular; $6\text{--}26 \times 0.3\text{--}4 \times 0.1\text{--}0.5$ cm; with persistent or deciduous (often when fruit mature) calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight or curved; not plicate; not twisted; symmetrical or asymmetrical; linear (or nearly so) or falcate; when asymmetrical with both sutures parallelly curved; not inflated; compressed; with beak; straight; with solid beak the same color and texture as fruit; long tapered to tapered at apex; apex oblique or aligned with longitudinal axis of fruit; tapered, long tapered, or short tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; chartaceous to coriaceous; seed chambers externally invisible (sometimes demarcated by coloration). Fruit margin not constricted; without sulcus; embellished; with thickened sutural areas. Fruit wings present; 4 (2 wings on each valve); 1–3 mm wide; valvular; on both valves. Fruit nonstipitate. Fruit with all layers dehiscent; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome or multicolored; bichrome and mottled (centrally, paler near sutures); brown or green (brownish); with brown overlay; glabrous or pubescent and indurate; with 2 types of pubescence; pilose; with pubescence white; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases swollen or plain; eglandular; without spines; smooth or not smooth; with elevated features; not veined; not tuberculate; dotted or lenticular; not exfoliating; without cracks. Mesocarp thin; surface not veined; 1- or 2-layered; without balsamic vesicles; without fibers; solid; with solid layer over solid layer; coriaceous or chartaceous. Endocarp dull; monochrome or mottled; tan or white; with mottling (dark); with brown overlay; smooth; septate; with septa thin (tissue paper-like), flexible; with septa eglandular; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds (4–)8–17; length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus less than 0.5 mm long to measured; 1–5 mm long; of 1 length only; filiform or

thick; straight. Aril present or absent; dry; rim-aril or partial rim-aril; entire; covering less than 1/2 of seed; without or with tongues (or flap-like) on lips of 2-lipped rim-aril; with 1 tongue or flap on 1 lip of 2-lipped rim-aril; tan.

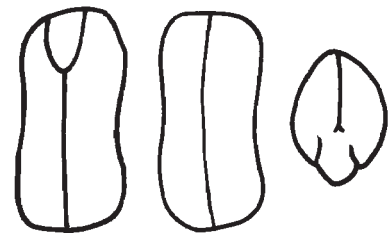
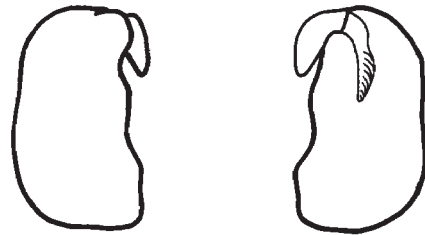
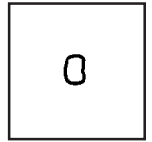
Seed $4.7\text{--}11.6 \times 3\text{--}8.4 \times 2\text{--}7$ mm; not overgrown; not angular or angular; symmetrical; ovate, reniform, or rectangular; terete to compressed; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; dull, glossy, or glaucous; not modified by a bloom; colored; monochrome; brown to reddish brown or black; glabrous; smooth; chartaceous. Fracture lines absent or present; reticulate. Rim absent. Wings absent. Raphe not visible. Hilum visible; with faboid split; with the lips of the faboid split lighter colored than the rest of the hilum and therefore conspicuous; larger than punctiform; 0.8–7.5 mm long; with curved or straight outline; elliptic to oval or linear; apical at apex of radicle tip to subapical to radicle tip or marginal according to radicle tip; slightly raised; not within corona, halo, or rim or within halo or rim. Hilum halo color darker than testa. Hilum rim color darker than testa. Lens discernible; less than 0.5 mm or equal to or greater than 0.5 mm in length; 0.5–0.8 mm long; with margins curved; circular; not in groove of raphe; adjacent to hilum; 0.5–1.3 mm from hilum; flush to mounded (slightly); dissimilar color from testa; lighter than testa; tan; within halo. Lens halo color darker than testa. Endosperm thin; covering entire embryo; adnate to testa. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; not concealing or partially concealing radicle; notched at radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; tan; inner face flat; glabrous around base of radicle. Embryonic axis deflexed; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; linear or bulbous; lobe tip straight; with 90-degree turn to oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule moderately to well developed; glabrous.

Distribution: Neotropics and subneotropics and cultivated in pantropics (*C. molle* van Martius ex G. Benth).

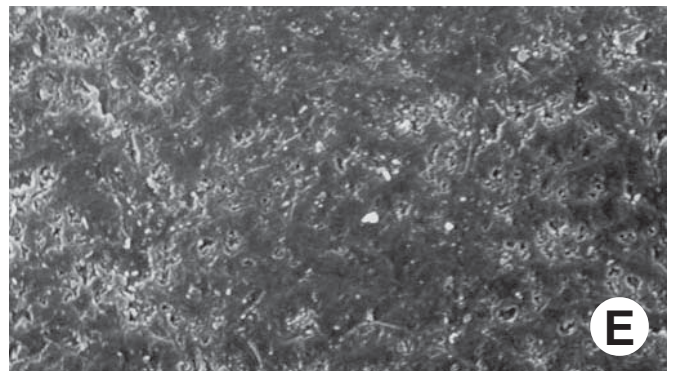
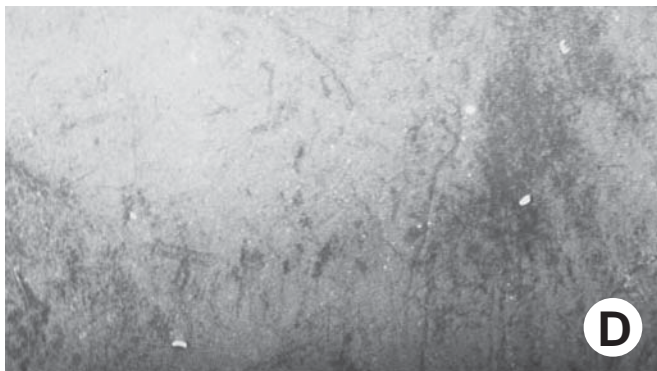
Notes: Barbosa-Fereira (1977) revised *Centrosema* for Brazil. Fantz (1996b) has shown that the agriculturally

important species formerly known as “*C. pubescens*” must be called *C. molle* Martius ex G. Benth. This species is widely distributed throughout the Neotropics at locations below 500 m. The name *C. pubescens* G. Benth. applies to a poorly known species found from Mexico to western Panama at elevations of 500–2,200m.

Centrosema: *C. plumieri* (J.P.F. Turpin ex C.H. Persoon)
G. Bentham (*B*), *C. virginianum* (C. Linnaeus) G.
Bentham (*D–F*), *C. spp.* (*A, C*). *A*, Fruits ($\times 0.9$);
B, valve ($\times 0.5$); *C*, seeds ($\times 4$); *D–E*, testa ($\times 50$,
 $\times 1000$); *F*, embryos ($\times 6$).



F



Genus: *Periandra* C.F.P. von Martius ex G. Benth

Phylogenetic Number: 10.15.

Tribe: Phaseoleae.

Subtribe: Clitoriinae.

Species Studied—Species in Genus: 6 spp.—6 spp.

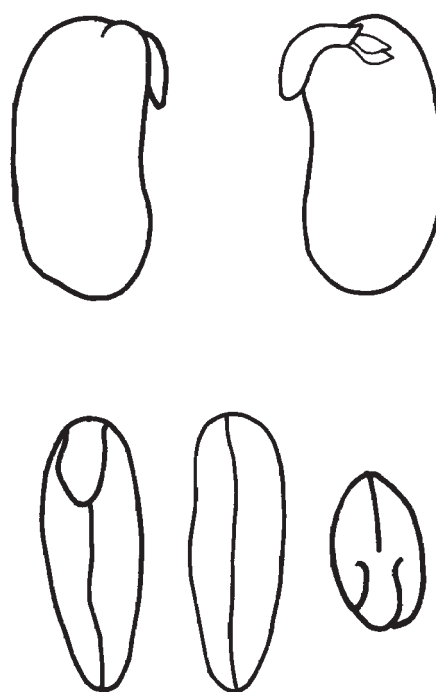
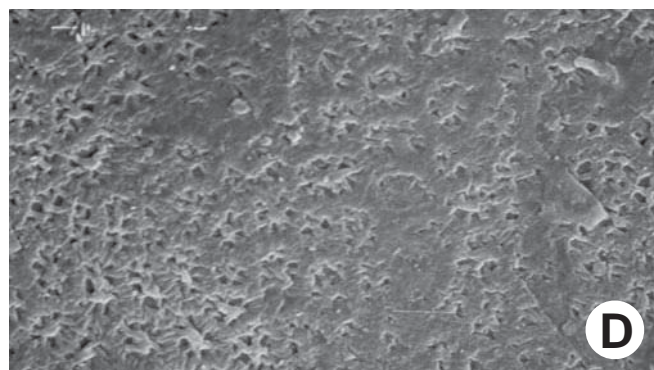
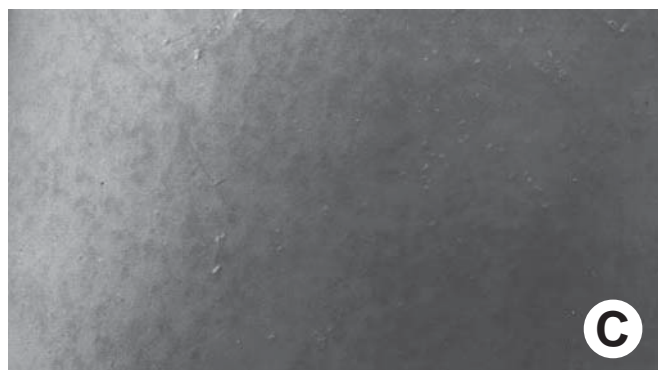
Fruit a legume; unilocular; $9-18 \times 0.4-0.8 \times 0.2-0.3$ cm; with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight to curved (slightly); not plicate; not twisted; symmetrical; linear; not inflated; flattened; without to with beak; straight; with papery fragile beak up to 1 cm long or solid beak the same color and texture as fruit; tapered at apex; apex aligned with longitudinal axis of fruit; tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous; seed chambers externally visible or invisible. Fruit margin not constricted; without sulcus; embellished; with thickened sutural areas. Fruit wings absent. Fruit substipitate; 0.5-1 mm long. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome; brown; pubescent and indurate; with 1 type of pubescence; puberulent; with pubescence golden; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; smooth; not tuberculate; not exfoliating; with or without cracks; cracking oblique to fruit length. Mesocarp thick; surface not veined; 2-layered; without balsamic vesicles; without fibers; with solid layer over solid layer; coriaceous. Endocarp dull; monochrome; orangish brown or white; smooth and cracked; subseptate; with septa thin (tissue paper-like), flexible; with septa eglandular; chartaceous; exfoliating in part; remaining fused to mesocarp and epicarp and separating from mesocarp; entire. Seeds 4-11; length parallel with or oblique to fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; 0.5-0.7 mm long; of 1 length only; flattened; triangular. Aril dry; rim-aril, tongue-aril, or 2-lipped rim-aril; entire; covering less than 1/2 of seed; without or with tongues (or flap-like) on lips of 2-lipped rim-aril; with 1 tongue or flap on 1 lip of 2-lipped rim-aril; tan.

Seed $6.6-8.1 \times 3.5-5 \times 1.8-3.3$ mm; not overgrown; not angular; symmetrical; elliptic or reniform; terete or compressed; with surface smooth; without visible

radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering or partially adhering to endocarp; dull; not modified by a bloom; colored; monochrome or mottled; with infrequent mottles; brown; with brown (darker) overlay; glabrous; smooth or not smooth; with recessed features; pitted with small separate pits; coriaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum partially concealed; concealed by aril; with faboid split; with the lips of the faboid split lighter colored than the rest of the hilum and therefore conspicuous; larger than punctiform; 1.8-2.8 mm long; with curved outline; elliptic; apical according to radicle tip but marginal according to seed length; flush; within rim. Hilum rim color darker than testa. Lens discernible; less than 0.5 mm or equal to or greater than 0.5 mm in length; up to 1.5 mm long; with margins straight or curved; linear or elliptic; not in groove of raphe; adjacent to hilum; 0.1-0.7 mm from hilum; recessed or flush; dissimilar color from testa; lighter or darker than testa; brown; not within corona, halo, or rim. Endosperm thin; covering entire embryo or at least 1/2 of embryo, but not entire embryo; adnate to testa. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing radicle; notched at radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; tan; inner face flat; glabrous around base of radicle. Embryonic axis deflexed or right angled; oblique or perpendicular to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; bulbous; lobe tip curved; deflexed and parallel to cotyledon length or oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule moderately to well developed; glabrous.

Distribution: Santo Domingo (1 sp.) and Brazil (5 spp.).

Periandra: *P. heterophylla* G. Benth (C-E), *P. spp.* (A-B). A, Fruits ($\times 1.1$); B, seeds ($\times 5$); C-D, testa ($\times 50$, $\times 1000$); E, embryos ($\times 5$).



Genus: *Clitoria* C. Linnaeus

Phylogenetic Number: 10.16.

Tribe: Phaseoleae.

Subtribe: Clitoriinae.

Species Studied—Species in Genus: 23 spp.—59 spp.
(Fantz, personal communication, 1998).

Fruit a legume; unilocular; $3.7\text{--}33 \times 0.5\text{--}5 \times 0.2\text{--}0.5$ cm; with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight to curved (slightly); not plicate; not twisted; symmetrical or asymmetrical; linear or falcate; when asymmetrical with both sutures parallelly curved; not inflated; compressed; with beak; straight; with solid beak the same color and texture as fruit; tapered to short tapered at apex; apex aligned with longitudinal axis of fruit; tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; chartaceous to coriaceous to leathery; seed chambers externally visible or invisible. Fruit margin not constricted; without sulcus; embellished; with flanges or thickened sutural areas. Fruit wings absent or present (only in sect. *Neurocarpum* (A.N. Desvaux) J.G. Baker); 2; 1 mm wide; valvular; on both valves (medial, occasionally incompletely formed). Fruit nonstipitate or substipitate (only in subgen. *Clitoria*); 0.5–1 mm long. Fruit with all layers dehiscent; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome or multicolored; mottled; brown or greenish brown or yellow; with brown overlay; with mottling over seed chambers; glabrous or glabrate or pubescent and indurate; with 1 or 2 types of pubescence; strigose and puberulent, puberulent and villous (sparsely), or puberulent; with pubescence gray; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; smooth or not smooth; with elevated features; not veined; not tuberculate; blistered or scurfy; not exfoliating; with or without cracks; cracking oblique to fruit length. Mesocarp thick to thin; 3-layered; without balsamic vesicles; without fibers; with vitreous layer over 2 distinct solid layers; coriaceous. Endocarp dull; mottled; white; with mottling over seed chambers; with brown overlay; scurfy; septate to subseptate; with septa thin (tissue paper-like), flexible; with septa eglandular; chartaceous; exfoliating in part; remaining fused to mesocarp and epicarp;

entire. Seeds 2–11; length parallel with or transverse (seeds nearly round) to fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; 0.5–5 mm long; of 1 length only; thick; triangular. Aril dry; 2-lipped rim-aril or rim-aril (with tongue); entire; covering less than 1/2 of seed; with tongues (or flap-like) on lips of 2-lipped rim-aril; with 1 tongue or flap on 1 lip of 2-lipped rim-aril or 2 tongues or flaps, 1 on each lip of 2-lipped rim-aril (smaller one on second lip); cream.

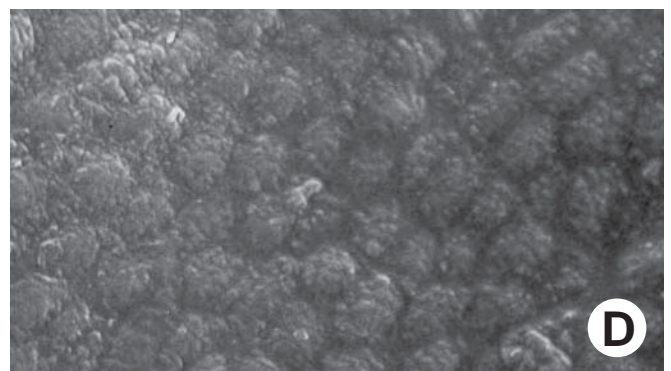
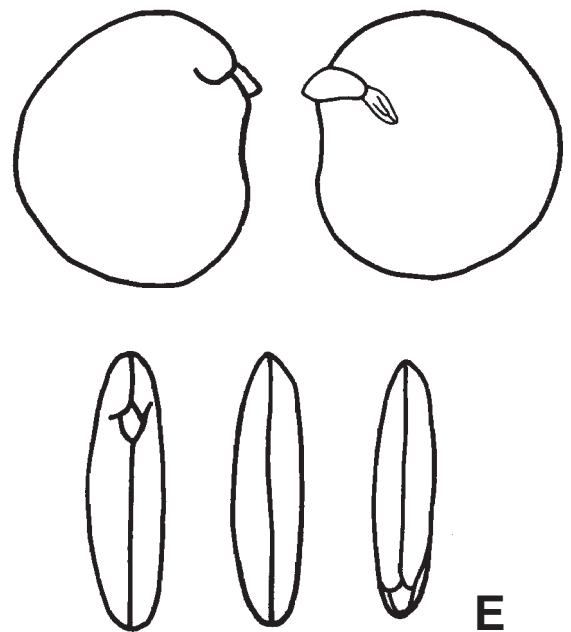
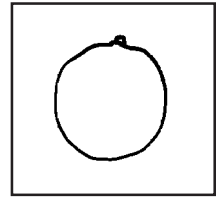
Seed $5\text{--}23 \times 4.8\text{--}22 \times 1.8\text{--}5$ mm; not overgrown; not angular or angular; symmetrical or asymmetrical (slightly); nearly circular, reniform, rhombic, or oblong; terete to compressed to flattened; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering or partially adhering to endocarp; glossy or dull; not modified by a bloom; colored; monochrome or mottled; with frequent mottles; reddish or dark brown or green (brownish); with black overlay; glabrous; smooth; chartaceous to coriaceous (sub). Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum visible or partially concealed; concealed by aril; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 1–1.3 mm long; with curved outline; oval; apical at apex of radicle tip to subapical to radicle tip to apical according to radicle tip but marginal according to seed length; raised or flush; within rim. Hilum rim color of, lighter, or darker than testa. Lens discernible; equal to or greater than 0.5 mm in length; 0.5–0.6 mm long; with margins curved; elliptic; not in groove of raphe; confluent with hilum; mounded; dissimilar color from testa; darker than testa; brown to black; not within corona, halo, or rim or within halo. Lens halo color darker than testa. Endosperm present or absent; thin; restricted to region of embryo or covering at least 1/2 of embryo, but not entire embryo; adnate to testa. Cotyledons smooth; both outer faces convex; 1 thicker than the other; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing radicle; split over radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; white to tan; inner face flat; glabrous around base of radicle. Embryonic axis deflexed, right angled, or straight (rarely); oblique or perpendicular to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; linear to triangular; lobe tip straight; oblique to cotyledons, deflexed and parallel to cotyledon width, with 90-

degree turn, or straight with embryonic axis (rarely); centered between cotyledons; less than 1/2 or 1/2 to nearly length of cotyledons. Plumule well to moderately developed; glabrous.

Distribution: Pantropics and North America.

Notes: *Clitoria polystachya* G. Bentham has sticky seeds, as does *Barbieria* (10.16A) (Delgado Salinas, personal communication, 1997).

Clitoria: *C. fairchildiana* R.A. Howard (*C–E*), *C. spp.* (*A–B*). *A*, Fruits ($\times 0.4$); *B*, seeds ($\times 2.8$); *C–D*, testa ($\times 50$, $\times 1000$); *E*, embryos ($\times 2$).



Genus: *Barbieria* A.-P. de Candolle

Phylogenetic Number: 10.16A.

Tribe: Phaseoleae.

Subtribe: Clitoriinae.

Species Studied—Species in Genus: 1 sp.—1 sp.

Fruit a legume; unilocular; $5.5\text{--}10 \times 0.5\text{--}0.6 \times 0.4$ cm; with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; symmetrical; linear to moniliform (slightly); not inflated; compressed; without beak; short tapered at apex; apex aligned to oblique with longitudinal axis of fruit; tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous; seed chambers externally visible; with the raised seed chambers not torulose. Fruit margin not constricted; without sulcus; plain. Fruit wings absent. Fruit substipitate; 0.5–1 mm long. Fruit with all layers dehiscent; splitting along sutures. Dehiscence of valves along both sutures; assumed apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome; brown; pubescent and indurate; with 1 type of pubescence; puberulent; with pubescence golden; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; not smooth; with elevated features; not veined; not tuberculate; dotted; not exfoliating; without cracks. Mesocarp thin; surface not veined; 2-layered; without balsamic vesicles; without fibers; with solid layer over spongy layer; coriaceous. Endocarp glossy; monochrome; yellow; smooth and spongy; septate; with septa thin (tissue paper-like), flexible; with septa eglandular; coriaceous; remaining fused to mesocarp and epicarp; entire. Seeds 3–7; length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; 0.7 mm long; of 1 length only; flattened; triangular. Aril dry; 2-lipped rim-aril; entire; covering less than 1/2 of seed; with tongues (or flap-like) on lips of 2-lipped rim-aril; with 1 tongue or flap on 1 lip of 2-lipped rim-aril; tan.

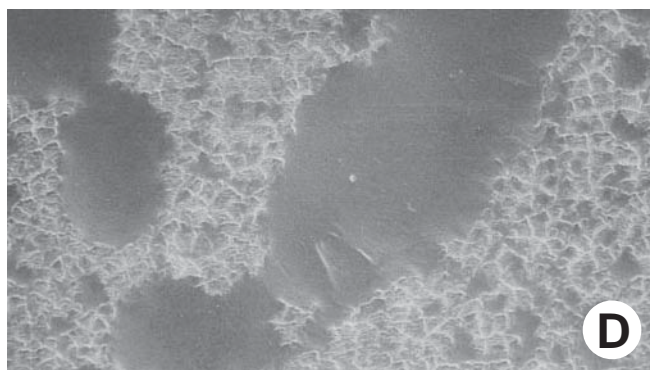
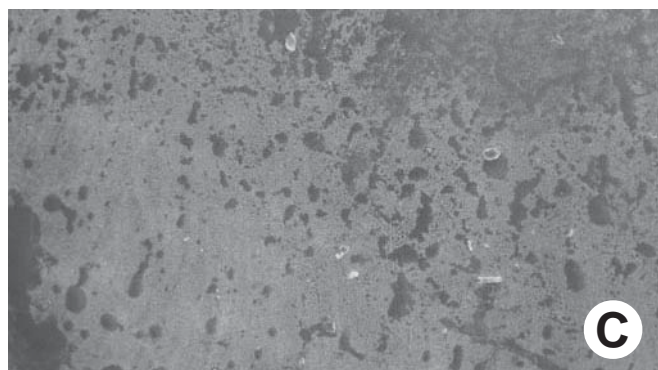
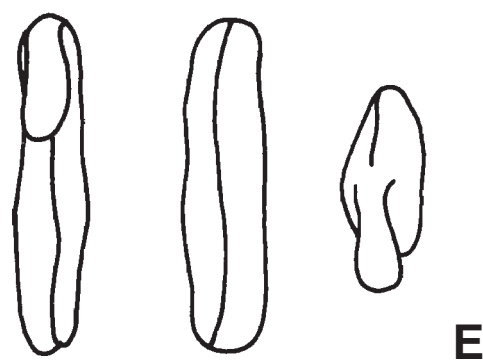
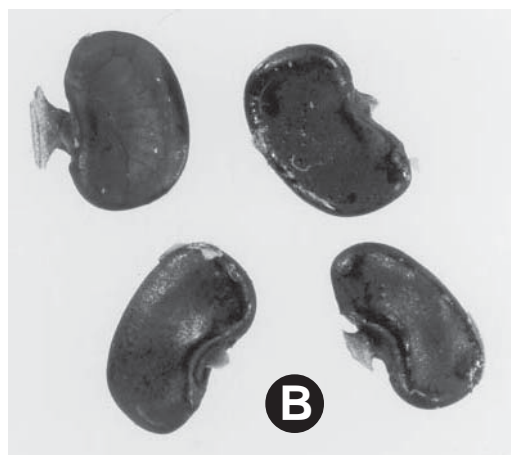
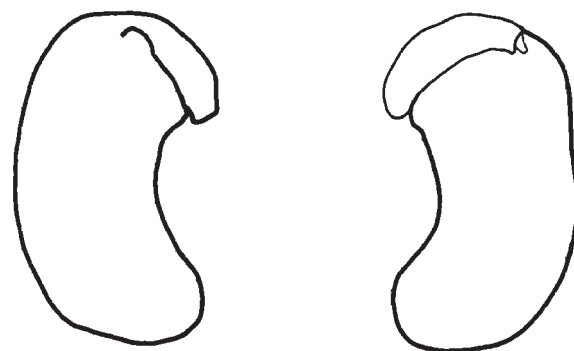
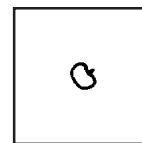
Seed $5\text{--}5.2 \times 3.1\text{--}3.8 \times 1.4$ mm; not overgrown; angular or not angular; asymmetrical; reniform to rectangular (nearly); compressed; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to

endocarp; glossy; not modified by a bloom; colored; monochrome; black to brown; glabrous; smooth; coriaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum partially concealed; concealed by aril; with faboid split; with the lips of the faboid split lighter colored than the rest of the hilum and therefore conspicuous; larger than punctiform; 1.4–1.5 mm long; with curved outline; elliptic; apical according to radicle tip but marginal according to seed length; recessed; within rim. Hilum rim color of or lighter than testa. Lens discernible; less than 0.5 mm or equal to or greater than 0.5 mm in length; up to 0.5 mm long; with margins straight; linear; not in groove of raphe; confluent with hilum; mounded; same color as testa; lighter than testa; brown; not within corona, halo, or rim. Endosperm thin; covering at least 1/2 of embryo, but not entire embryo; adnate to testa. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin not entire 180 degrees from base of radicle; similar at apex; partially concealing radicle; notched at radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; yellow; inner face flat; glabrous around base of radicle. Embryonic axis oblique; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; bulbous; lobe tip curved; deflexed and parallel to cotyledon width or oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Southern Mexico to Peru, Venezuela, Brazil, and the Caribbean.

Notes: Smith and Lewis (1991) and Lackey (1981b) included the genus *Barbieria* in *Clitoria* (10.16), but Fantz (1996a) maintained it as a genus. We are following the latter author. *Barbieria* has sticky seeds, as does *Clitoria polystachya* G. Benth (10.16) (Delgado Salinas, personal communication, 1997).

Barbieria: *B. pinnata* (C.H. Persoon) H.E. Baillon (A–E). A, Fruits ($\times 1.7$); B, seeds ($\times 5.8$); C–D, testa ($\times 50$, $\times 1000$); E, embryos ($\times 10$).



Genus: *Dioclea* K.S. Kunth

Phylogenetic Number: 10.18.

Tribe: Phaseoleae.

Subtribe: Diocleinae.

Species Studied—Species in Genus: 13 spp.—30 spp.

Fruit a legume; unilocular; $11.5\text{--}30 \times 3.5\text{--}6 \times 2$ cm; with persistent or deciduous calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight or curved (slightly); not plicate; not twisted; asymmetrical; linear or moniliform; when asymmetrical with 1 straight and 1 curved suture, both sutures unequally curved, or both sutures nearly straight; widest near middle or D-shaped; not inflated; compressed; without beak; rounded at apex; apex aligned or oblique with longitudinal axis of fruit; rounded at base; base aligned or oblique with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous to leathery to ligneous; seed chambers externally invisible. Fruit margin not constricted; without sulcus; plain and embellished, plain, or embellished. Fruit wings present or absent; 2 or 4 (one wing on each valve, two wings on upper suture, or two wings on both sutures); 1–5 mm wide; valvular or sutural; on both valves; on 1 or both sutures. Fruit stipitate or nonstipitate; with the stipe up to 30 mm long. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome or multicolored; mottled; brown, black, or yellow; with brown overlay; with mottling over seed chambers; glabrous, pubescent and indurate, or pubescent but soon deciduous; with 1 type of pubescence; puberulent, tomentose, or sericeous; with pubescence golden; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; smooth or not smooth; with elevated features; veined or not veined; reticulately veined; not tuberculate; wrinkled; exfoliating in part; with cracks; cracking oblique to fruit length. Mesocarp thick or thin; surface uniformly veined; 2-layered; without balsamic vesicles; with fibers present or without fibers; with fibers over solid layer; with vitreous layer over solid layer; ligneous or coriaceous. Endocarp dull; monochrome or mottled; brown, white, or yellow; with mottling (dark); with brown overlay; cracked or smooth and hairy; with hairs surrounding seed chambers; subseptate or nonseptate;

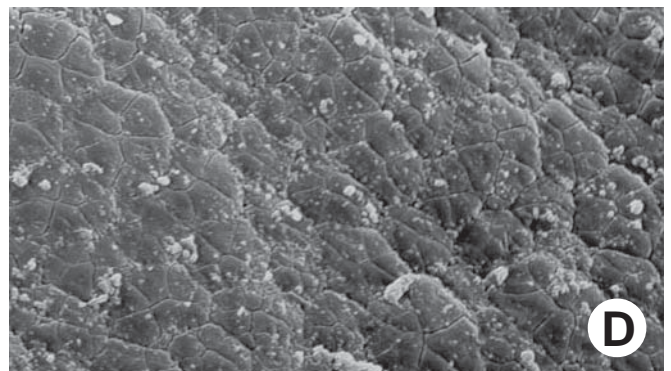
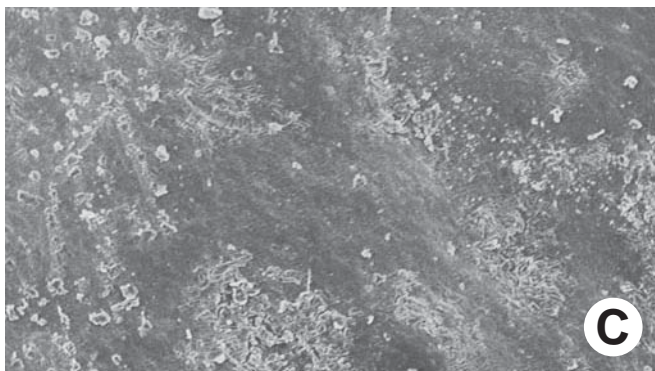
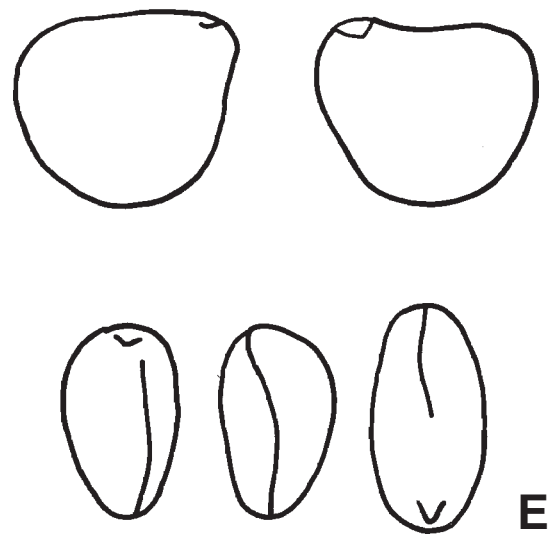
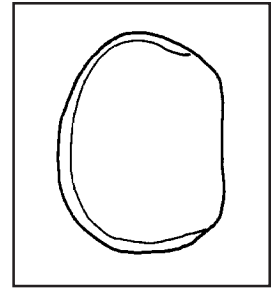
with septa thin (tissue paper-like), flexible; with septa eglandular; chartaceous; exfoliating in part; separating from mesocarp; entire. Seeds (1–)3–13; length oblique or transverse to fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; 2–50 mm long; of 1 length only; thick; curved or triangular. Aril dry; rim-aril and tongue-aril, 2-lipped rim-aril, or rim-aril; entire; covering less than 1/2 of seed; with tongues (or flap-like) on lips of 2-lipped rim-aril; with 2 tongues or flaps, 1 on each lip of 2-lipped rim-aril; ivory to tan.

Seed $7.5\text{--}27 \times 5.3\text{--}24.5 \times 3.4\text{--}15$ mm; not overgrown; angular or not angular; symmetrical or asymmetrical; oblong or ovate; terete or compressed; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering or partially adhering to endocarp; dull; not modified by a bloom; colored; mottled; with frequent mottles; reddish brown or tan; with brown overlay; glabrous; smooth; chartaceous or osseous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum visible; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 2–80 mm long; with curved or straight outline (around 3 sides of seed); elliptic or linear; apical according to radicle tip but marginal according to seed length; flush; within rim or not within corona, halo, or rim. Hilum rim color darker than testa. Lens discernible; equal to or greater than 0.5 mm in length; 0.6–1.5 mm long; with margins straight; linear; not in groove of raphe; confluent with hilum; recessed; similar color as testa; darker than testa; brown; within rim or within halo. Lens halo color darker than testa. Lens rim color darker than testa. Endosperm thin; restricted to region of embryo; adnate to testa. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing radicle; entire over or notched at radicle; without lobes; with the interface division terminating at base of radicle; without or with 1 margin recessed; recessed on side opposite from radicle; tan; inner face flat; glabrous around base of radicle. Embryonic axis oblique; parallel, oblique, or perpendicular to length of seed. Radicle differentiated from cotyledon; bulbous or triangular; lobe tip straight; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule moderately developed or rudimentary; glabrous.

Distribution: Pantropics.

Notes: *Dioclea multiflora* (J. Torrey & A. Gray) C.T. Mohr has been placed in the genera *Dolichos* (10.64) and *Galactia* (10.27) at different times (Maxwell 1979), and was also segregated as the monotypic genus *Lackeya* R.H. Fortunato, L.P. de Queiroz & G.P. Lewis, as *L. multiflora* (J. Torrey & A. Gray) R.H. Fortunato, L.P. de Queiroz & G.P. Lewis (Fortunato et al. 1996). Pending further evaluation of its status, we have chosen to include it in *Dioclea*.

Dioclea: *D. reflexa* J.D. Hooker (*C–E*), *D. spp.* (*A–B*). *A*,
Fruits ($\times 0.5$); *B*, seeds ($\times 1.3$); *C–D*, testa ($\times 50$,
 $\times 1000$); *E*, embryos ($\times 1$).



Genus: *Cymbosema* G. Benth

Phylogenetic Number: 10.19.

Tribe: Phaseoleae.

Subtribe: Diocleinae.

Species Studied—Species in Genus: 1 sp.—1 sp.

Fruit a legume; unilocular; $4.4\text{--}6 \times 1.8\text{--}2.2 \times 0.4\text{--}0.7$ cm; with deciduous calyx; without orifice formed by curving of fruit or fruit segments; slightly curved; not plicate; not twisted; asymmetrical or symmetrical; oblong or falcate; when asymmetrical with both sutures parallelly curved; not inflated; compressed; with beak; declined; with solid beak the same color and texture as fruit; short tapered at apex; apex oblique with longitudinal axis of fruit; rounded or short tapered at base; base oblique with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous; seed chambers externally invisible. Fruit margin constricted or not constricted; slightly constricted only on 1 margin; without sulcus; embellished; with ridges. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscent; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome; brown; pubescent and indurate; with 1 type of pubescence; sericeous; with pubescence golden; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; smooth; not veined; not tuberculate; not exfoliating; with cracks; cracking oblique to fruit length. Mesocarp thin; 2-layered; without balsamic vesicles; with fibers; with fibers over solid layer (resembling tomentose layer where endocarp exfoliates); coriaceous. Endocarp dull; monochrome; brown; smooth; septate; with septa thin (tissue paper-like), flexible; with septa eglandular; chartaceous; exfoliating in part; remaining fused to mesocarp and epicarp; entire. Seeds 2–5; length transverse to fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; 10–15 mm long; of 1 length only; flattened; triangular. Aril dry; rim-aril; crenate; covering less than 1/2 of seed; without tongue (or flap-like) on lips of 2-lipped rim-aril; tan.

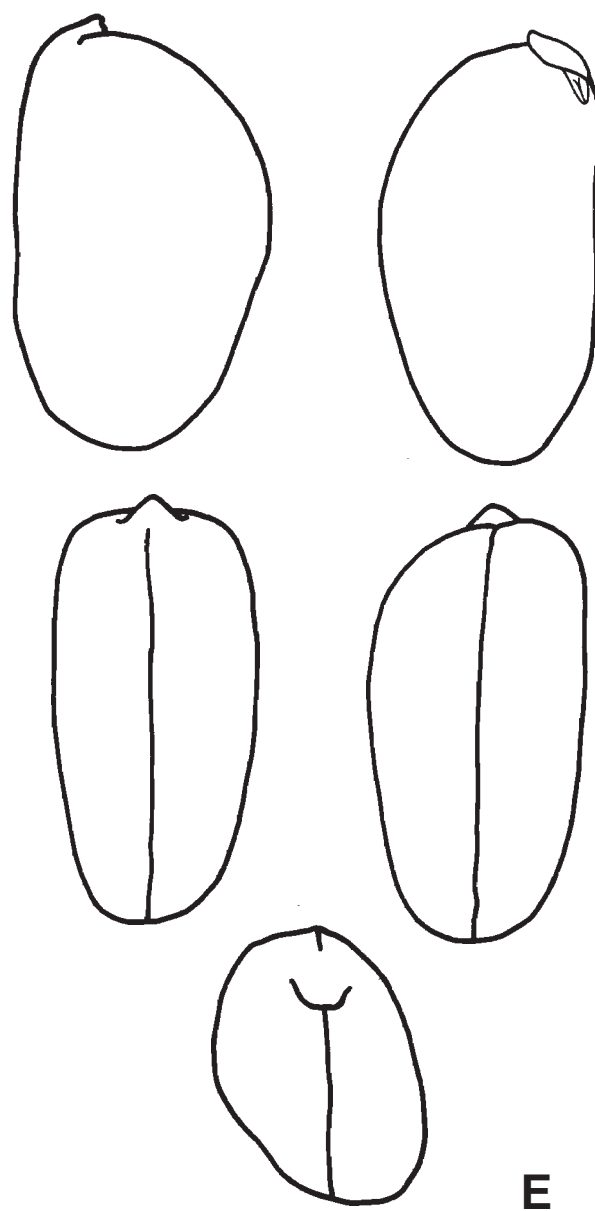
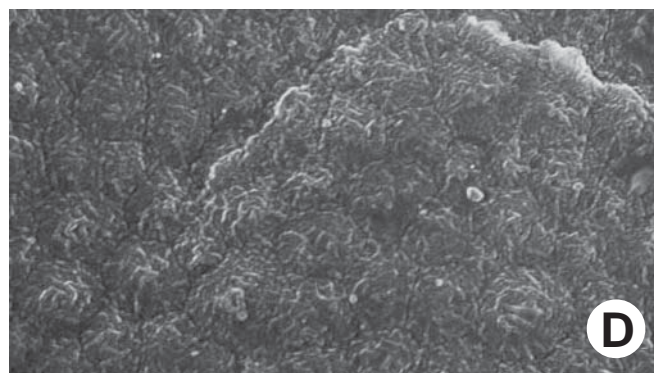
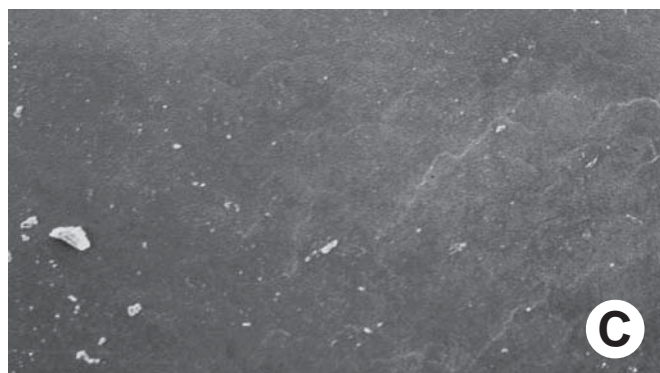
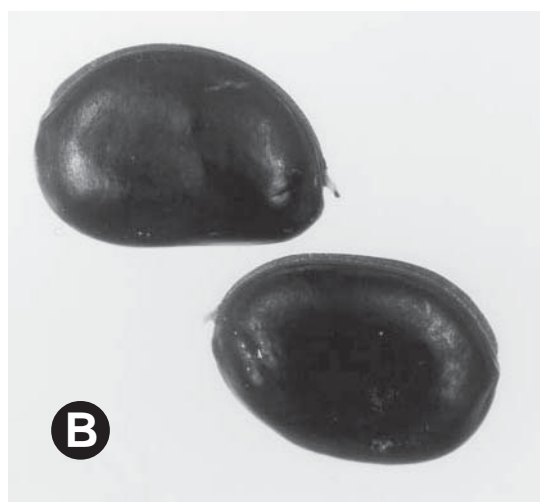
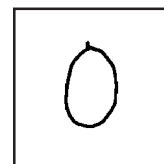
Seed $10\text{--}14 \times 6\text{--}8.5 \times 4\text{--}5.6$ mm; not overgrown; not angular; symmetrical; oblong to ovate or reniform; compressed; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus;

without umbo on seed faces. Testa not adhering to endocarp; glossy; not modified by a bloom; colored; monochrome; dark brown; glabrous; smooth; coriaceous. Fracture lines concentric. Rim absent. Wings absent. Raphe not visible. Hilum visible; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 13–13.2 mm long; with straight outline; linear; marginal according to radicle tip; raised; within rim. Hilum rim color darker than testa. Lens discernible; equal to or greater than 0.5 mm in length; 0.5–0.8 mm long; with margins straight; linear; not in groove of raphe; confluent with hilum; flush; same color as testa; dark brown; not within corona, halo, or rim. Endosperm trace; restricted to region of embryo; adnate to testa. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing radicle; split over radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; tan; inner face flat; glabrous around base of radicle. Embryonic axis oblique; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; triangular; lobe tip straight; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule moderately developed; glabrous.

Distribution: Tropical Mexico, Central America, and South America reaching to Brazil (Amazonia).

Notes: Maxwell (1970) monographed *Cymbosema*.

Cymbosema: *C. roseum* G. Benth (A–E). A, Fruits ($\times 1.6$); B, seeds ($\times 3.5$); C–D, testa ($\times 50$, $\times 1000$); E, embryos ($\times 5$).



Genus: *Cleobulia* C.F.P. von Martius ex G. Benth

Phylogenetic Number: 10.20.

Tribe: Phaseoleae.

Subtribe: Diocleinae.

Species Studied—Species in Genus: 2 spp.—3 spp.

Fruit a legume; unilocular; $6-10 \times 1.5-2.3 \times 0.2-0.5$ cm; with persistent or deciduous calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; asymmetrical; oblong, harp-shaped, or irregular; when asymmetrical with 1 straight and 1 curved suture, both sutures unequally curved, or both sutures nearly straight; widest near apex; not inflated; compressed; without beak; truncate or blunt at apex; apex aligned or oblique with longitudinal axis of fruit; tapered or short tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous; seed chambers externally visible; with the raised seed chambers not torulose. Fruit margin constricted or not constricted; slightly constricted along both margins; without sulcus; plain or embellished; with thickened sutural areas. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscent; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome; brown; pubescent and indurate; with 1 type of pubescence; puberulent to tomentose; with pubescence golden or brown; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; not veined; not tuberculate; with or without cracks; cracking oblique to fruit length. Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; solid; subligneous. Endocarp dull; monochrome; yellow; smooth and floury-filamentous; nonseptate; exfoliating in part; remaining fused to mesocarp and epicarp. Seeds 6–7; length transverse to fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; up to 10.5 mm long; of 1 length only; flattened; curved. Aril dry; partial rim-aril; fimbriate; cream or brown (dark).

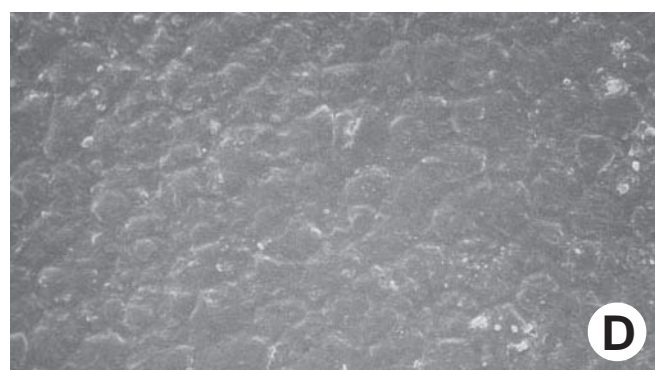
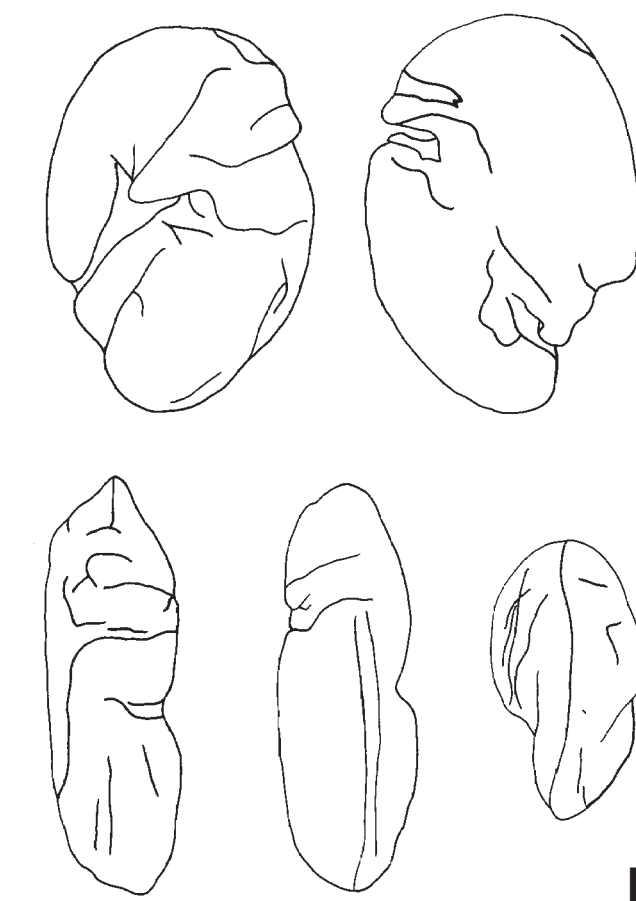
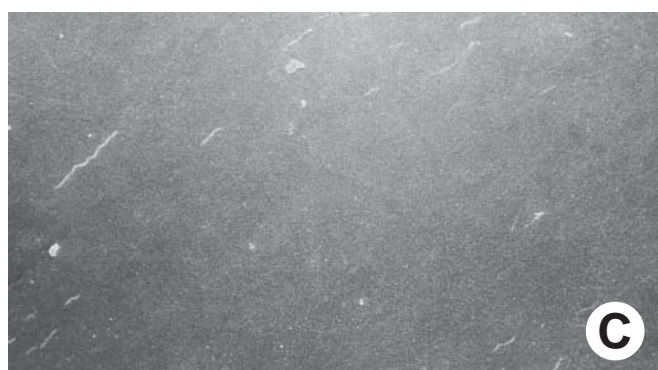
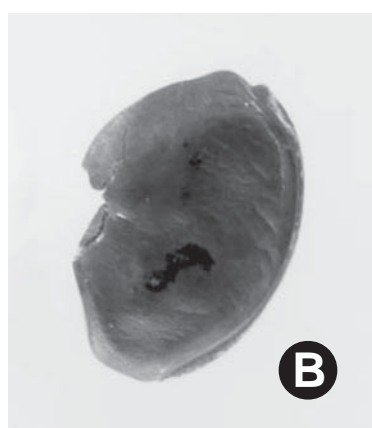
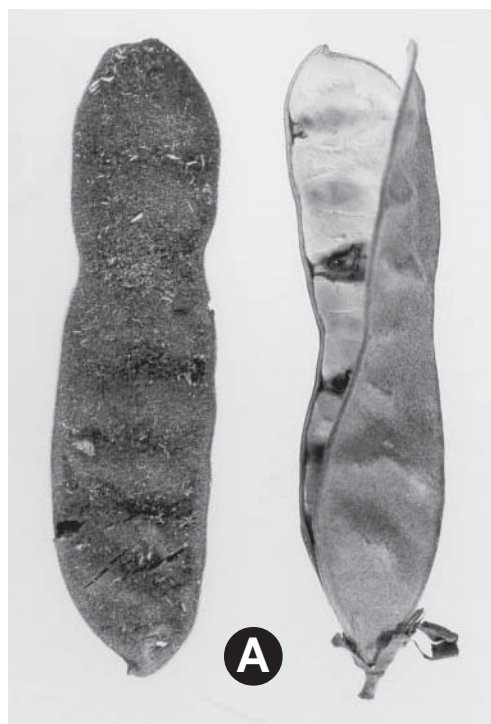
Seed $8.4 \times 6 \times 2.5$ mm; not overgrown; not angular; symmetrical; ovate or reniform (Maxwell 1977); compressed; with surface smooth; without or with (rarely) visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not

adhering to endocarp; glossy; not modified by a bloom; colored; monochrome; brown; glabrous; smooth; coriaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum visible; with faboid split; with the lips of the faboid split lighter colored than the rest of the hilum and therefore conspicuous; larger than punctiform; 6–8.5 mm long; with straight outline; linear; marginal according to radicle tip; slightly raised; within rim. Hilum rim color darker than testa. Lens discernible; equal to or greater than 0.5 mm in length; 0.6 mm long; with margins straight; wedge-shaped; not in groove of raphe; confluent with hilum; mounded; dissimilar color from testa; darker than testa; black; not within corona, halo, or rim. Endosperm absent. Cotyledons not smooth; convoluted; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin not entire 180 degrees from base of radicle; notched; similar at apex; completely concealing radicle; entire over radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; tan to brown; inner face flat and wavy (in different areas); glabrous around base of radicle. Embryonic axis straight; almost perpendicular to length of seed; with a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; linear; lobe tip straight; deflexed and parallel to cotyledon width; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Brazil.

Notes: Maxwell (1977) prepared a résumé of the genus. The two studied seeds were immature.

Cleobulia: *C. leiantha* G. Benth (E), *C. multiflora* C.F.P. von Martius ex G. Benth (B–D), *C. spp* (A). A, Fruits ($\times 1.1$); B, seed ($\times 5.1$); C–D, testa ($\times 50$, $\times 1000$); E, embryos ($\times 9$).



Genus: *Canavalia* A.-P. de Candolle

Phylogenetic Number: 10.21.

Tribe: Phaseoleae.

Subtribe: Diocleinae.

Species Studied—Species in Genus: 23 spp.—50 spp.

Fruit a legume; unilocular; $7-40 \times 1.5-6 \times 0.7-3$ cm; with persistent or deciduous calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; symmetrical; linear; not inflated or inflated (slightly, from literature); compressed to terete; without or with beak; straight or declined; with solid beak the same color and texture as fruit; tapered or short tapered at apex; apex aligned with longitudinal axis of fruit; tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous or ligneous; seed chambers externally invisible. Fruit margin not constricted; without sulcus; embellished; with thickened sutural areas or thickened sutural areas and wings. Fruit wings present or absent; 2 or 4 (one wing on each valve, sometimes two wings on upper suture); 1–1.5 mm wide; valvular or valvular and sutural; on both valves; on 1 suture. Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; multicolored; mottled; tan or brown; with brown overlay; glabrous or pubescent and indurate; with 1 type of pubescence; pilose; with pubescence white; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; smooth or not smooth; with elevated features; veined or not veined; transversely veined relative to fruit length; not tuberculate; wrinkled; exfoliating in part or not exfoliating; with or without cracks; cracking oblique to fruit length. Mesocarp thick; surface not veined; 1- or 2-layered; without balsamic vesicles; without fibers; solid; with vitreous layer over solid layer; subligneous to coriaceous. Endocarp dull; monochrome or mottled; tan to white; with mottling (dark); with brown overlay; scurfy and smooth (over seed chambers) or floury-filamentous; subseptate; with septa thin (tissue paper-like), flexible; with septa eglandular; chartaceous; exfoliating in part; remaining fused to mesocarp and epicarp; entire. Seeds 3–15; length oblique or transverse to fruit length; neither overlapping nor touching or touching; in 1 series.

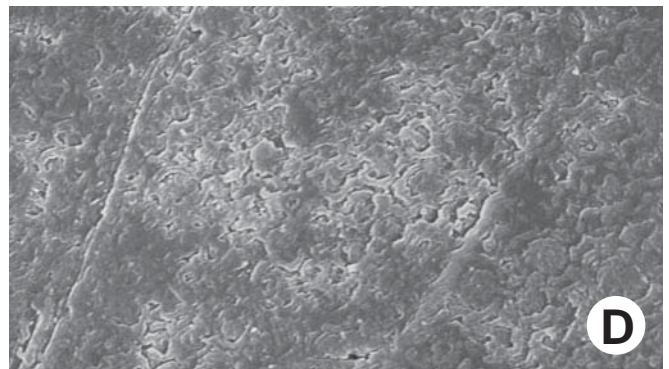
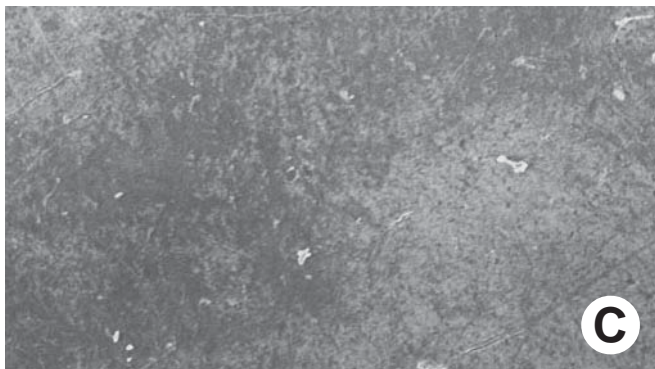
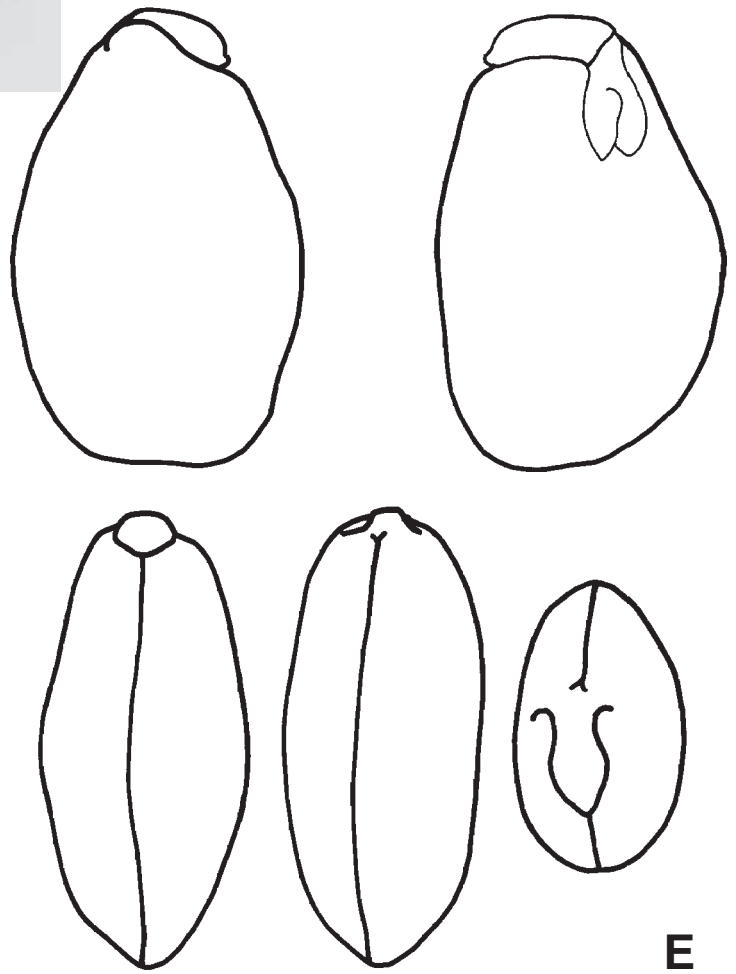
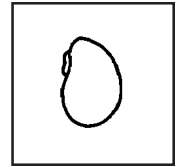
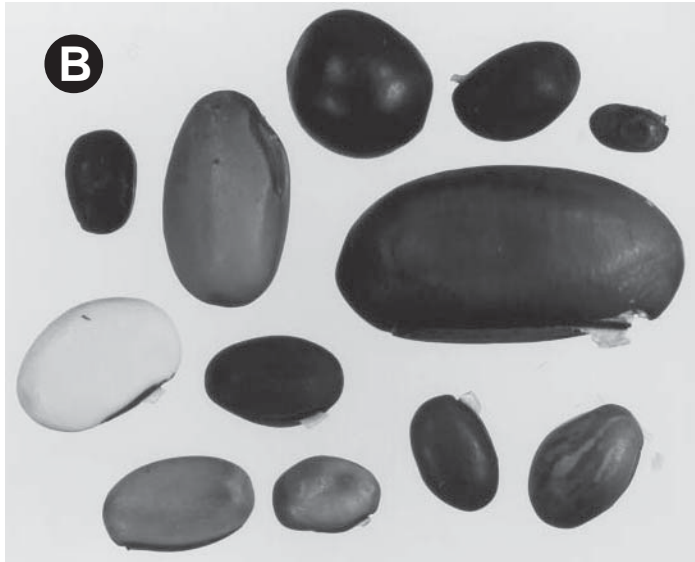
Funiculus measured; 5–30 mm long; of 1 length only; thick; straight or triangular (long). Aril dry; rim-aril and tongue-aril, rim-aril, or 2-lipped rim-aril; entire or fimbriate; covering less than 1/2 of seed; without tongue (or flap-like) on lips of 2-lipped rim-aril; with 1 tongue or flap on 1 lip of 2-lipped rim-aril; tan.

Seed $7-48 \times 5-25 \times 2-21$ mm; not overgrown; not angular; symmetrical or asymmetrical (slightly); elliptic to oblong or ovate; terete or compressed; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; dull; not modified by a bloom; colored; monochrome or mottled; with infrequent or frequent mottles; brown to reddish brown or ivory; with brown (dark) overlay; glabrous; smooth; coriaceous or osseous. Fracture lines absent. Rim absent. Raphe not visible or visible; from lens to base of seed and terminating; not bifurcating; darker than testa; dark brown; raised. Hilum visible; with faboid split; with the lips of the faboid split lighter colored than the rest of the hilum and therefore conspicuous; larger than punctiform; 5–35 mm long; with straight outline; linear; marginal according to radicle tip; flush or raised (slightly); not within corona, halo, or rim or within rim. Hilum rim color of or darker than testa. Lens discernible or not discernible; less than 0.5 mm to equal to or greater than 0.5 mm in length; up to 1 mm long; with margins straight; linear; not in groove of raphe; confluent with hilum; recessed; same color as testa; brown; not within corona, halo, or rim or within rim. Lens rim color darker than testa. Endosperm absent or present; trace; restricted to region of embryo; adnate to testa. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin not entire 180 degrees from base of radicle; notched; similar at apex; partially concealing radicle; split over or notched at radicle; with or without lobes; with lobes not touching, touching (auriculate), or overlapping; without or with basal groin formed by lobes; with the interface division terminating at base of radicle; without margins recessed; white to tan; inner face flat; glabrous around base of radicle. Embryonic axis oblique or right angled; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; bulbous or linear; lobe tip straight or curved; oblique to cotyledons, with 90-degree turn, or straight with embryonic axis; centered between cotyledons; less than 1/2 length of cotyledons. Plumule well developed; glabrous.

Distribution: Pantropical.

Notes: Sauer (1964) monographed *Canavalia* and illustrated its seeds. Adema (1997) reviewed the nine Malesian species, and illustrated the fruits for five of them.

Canavalia: *C. septentrionalis* J. Sauer (*C–E*), *C. spp.* (*A–B*).
A, Fruits ($\times 0.3$); B, seeds ($\times 1.1$); C–D, testa ($\times 50$,
 $\times 1000$); E, embryos ($\times 5$).



Genus: *Macropsychanthus* H.A.T. Harms & C.A.G. Lauterbach

Phylogenetic Number: 10.22.

Tribe: Phaseoleae.

Subtribe: Diocleinae.

Species Studied—Species in Genus: 2 spp.—4 spp.

Fruit a legume; unilocular; 12.5–20 (from literature) \times 4.3–5.5 (from literature) \times 1.6–2.5 (from literature) cm; without orifice formed by curving of fruit or fruit segments; slightly curved; not plicate; not twisted; asymmetrical; falcate; when asymmetrical with both sutures parallelly curved; not inflated; compressed (from literature); with beak (from literature); with solid beak the same color and texture as fruit (from literature); long tapered or rounded at apex (from literature); apex aligned with longitudinal axis of fruit; tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous. Fruit margin not constricted; without sulcus; plain. Fruit wings absent. Epicarp dull; monochrome; brown; assumed pubescent and indurate; with 1 type of pubescence; sericeous; with pubescence golden; with pubescence uniformly distributed; with simple hairs; stiff; with hair bases plain; eglandular; without spines; not veined; not tuberculate. Seeds 2–5 (from literature). Aril dry; narrow rim-aril; entire; covering less than 1/2 of seed; cream.

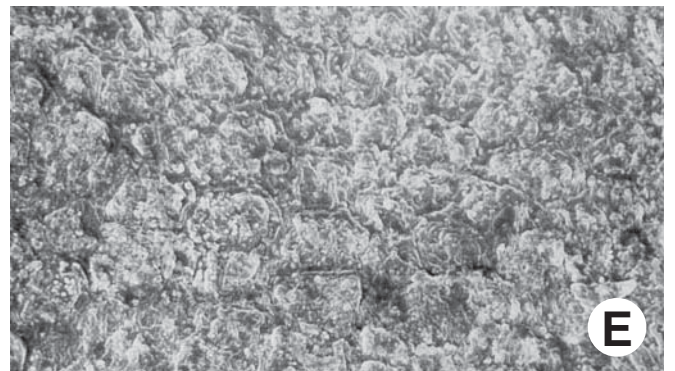
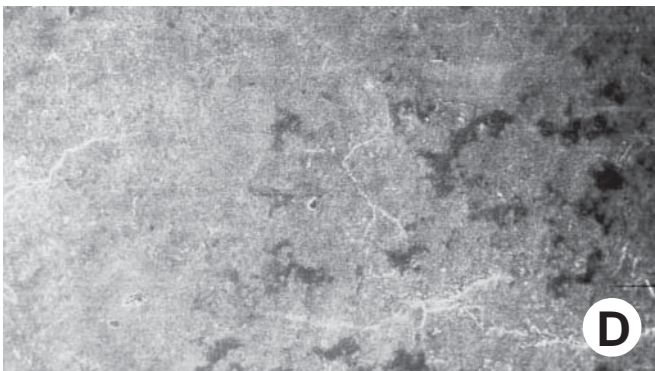
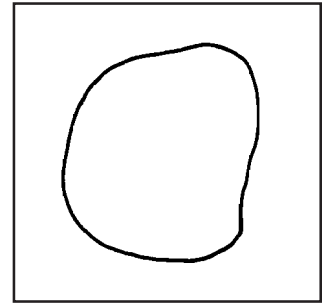
Seed 25–30 (from literature) \times 20–30 (from literature) \times 10–18 (from literature) mm; not overgrown; angular; symmetrical; D-shaped or rectangular (nearly); compressed; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without or with umbo on seed faces; with umbo on both faces of seed. Testa not adhering or partially adhering to endocarp; dull; not modified by a bloom; colored; mottled; reddish brown; with brown overlay; glabrous; smooth or not smooth; with elevated features; wrinkled or tuberculate (from literature); osseous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum fully concealed; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 67–80 mm long; with straight outline (around 3/4 of seed); linear; marginal according to radicle tip; raised; not within corona, halo, or rim. Lens discernible; equal to or greater than 0.5 mm in length; 2 mm long; with margins straight; linear;

not in groove of raphe; confluent with hilum; recessed; same color as testa; brown; not within corona, halo, or rim. Endosperm absent. Cotyledons smooth; both outer faces convex; 1 thicker (slightly) than the other; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing radicle; entire over radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; tan; inner face flat; glabrous around base of radicle. Embryonic axis straight; parallel to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; bulbous; lobe tip straight; straight with embryonic axis; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

Distribution: New Guinea, Philippines, and Micronesia.

Notes: Lackey (1981b) noted “scarcely distinguishable from *Dioclea*” (10.18). The fruits and seeds of the two genera are very similar. Partial fruit data taken from young fruits of *Macropsychanthus lauterbachii* H.A.T. Harms ssp. *glabricalyx* Verdcourt (isotype at U.S. National Herbarium, Smithsonian Institution).

Macropsychanthus: *M. dolichobotrys* L.B. Holthuis (C–E), *M. mindanaensis* E.D. Merrill (A), *M. spp.* (B). A–B, Fruit (\times 1, \times 0.5); C, seeds (\times 1.4); D–E, testa (\times 50, \times 1000).



Genus: *Camptosema* W.J. Hooker & G.A.W. Arnott

Phylogenetic Number: 10.24.

Tribe: Phaseoleae.

Subtribe: Diocleinae.

Species Studied—Species in Genus: 7 spp.—12 spp.

Fruit a legume; unilocular; $(4-5-15 \times 0.6-1.4 \times 0.2-0.3$ cm; with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight or curved (slightly); not plicate; not twisted; asymmetrical or symmetrical; linear or falcate; when asymmetrical with both sutures parallelly curved; not inflated; compressed; with beak; with solid beak the same color and texture as fruit; tapered at apex; apex aligned, oblique, or right-angled with longitudinal axis of fruit; tapered at base; base oblique with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous; seed chambers externally invisible. Fruit margin not constricted; without sulcus; plain or embellished; with thickened sutural areas. Fruit wings absent. Fruit nonstipitate or stipitate (rarely); with the stipe 5–7 mm long. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome; black; pubescent and indurate; with 1 type of pubescence; puberulent, velutinous, or sericeous; with pubescence golden or white; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; not smooth; with elevated features; not veined; not tuberculate; rugose or scaly; not exfoliating; with cracks; cracking oblique to fruit length. Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; coriaceous. Endocarp dull; monochrome or mottled; brown; with brown overlay; smooth and floury-filamentous; septate or nonseptate; with septa thin (tissue paper-like), flexible; with septa eglandular; chartaceous; exfoliating or exfoliating in part; remaining fused to mesocarp and epicarp; entire. Seeds 3–14; length transverse to fruit length (some round); neither overlapping nor touching; in 1 series. Funiculus measured; 1–2 mm long; of 1 length only; flattened; straight. Aril dry; rim-aril or tongue-aril; entire; covering less than 1/2 of seed; tan.

Seed $(4.5-8-9.6 \times 5.5-7.2 \times 2.3-6$ mm; not overgrown; not angular; symmetrical; elliptic or ovate; terete or

compressed; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; dull; not modified by a bloom; colored; monochrome; brown; glabrous; smooth; coriaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum visible; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 1.5–2.8 mm long; with curved outline; oval; subapical to or marginal according to radicle tip; recessed; within rim and halo. Hilum halo color lighter than testa. Hilum rim color darker than testa. Lens discernible; less than 0.5 mm or equal to or greater than 0.5 mm in length; up to 0.8(–2) mm long; with margins straight; linear; not in groove of raphe; confluent with hilum; flush; dissimilar color from testa; darker than testa; dark brown; not within corona, halo, or rim. Endosperm thin or trace; restricted to region or covering at least 1/2 of embryo, but not entire embryo; adnate to testa. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing radicle; entire over radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; tan; inner face flat; glabrous around base of radicle. Embryonic axis oblique to right angled; oblique to perpendicular to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; linear; lobe tip straight; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

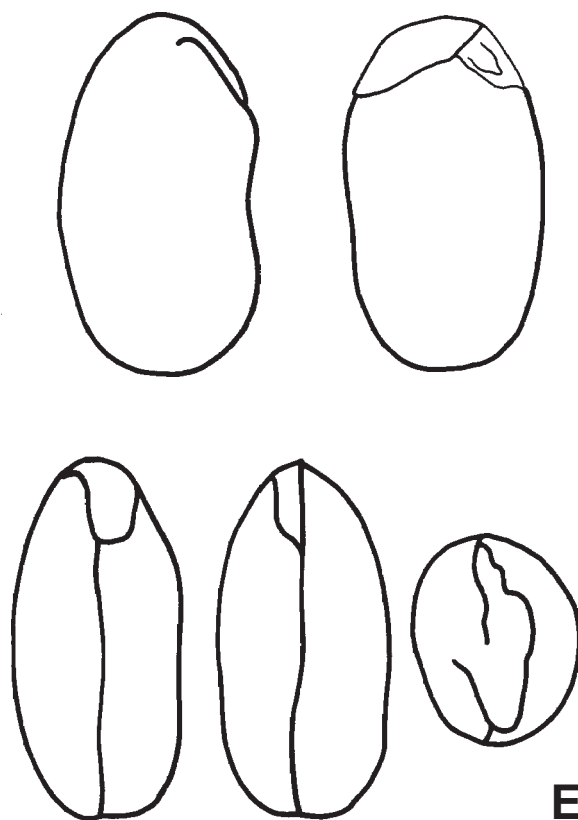
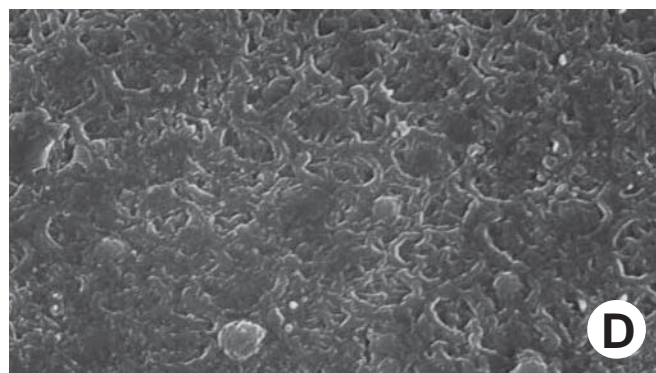
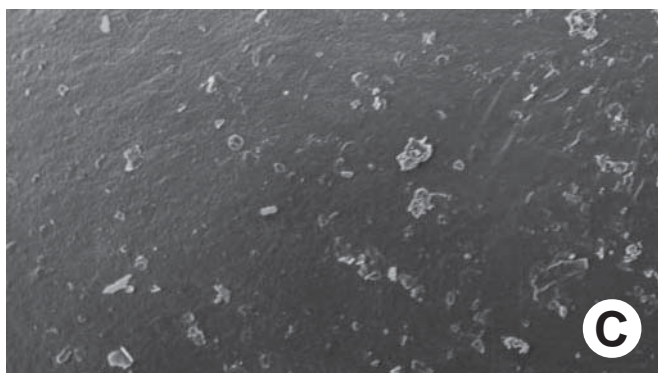
Distribution: South America.

Notes: Burkart (1970) revised the four species of Argentine *Camptosema*.

Camptosema: *C. rubicundum* W.J. Hooker & G.A.W.

Arnott (*C-E*), *C. spp.* (*A-B*). *A*, Fruits ($\times 1.4$); *B*, seeds ($\times 5.3$); *C-D*, testa ($\times 50$, $\times 1000$); *E*, embryos ($\times 5$).

0



E

Genus: *Cratylia* C.F.P. von Martius ex G. Bentham

Phylogenetic Number: 10.25.

Tribe: Phaseoleae.

Subtribe: Diocleinae.

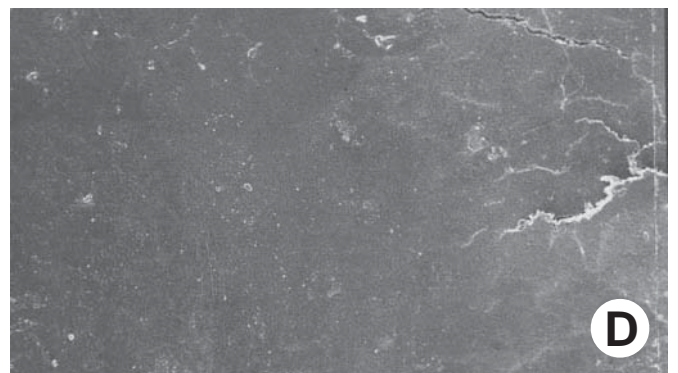
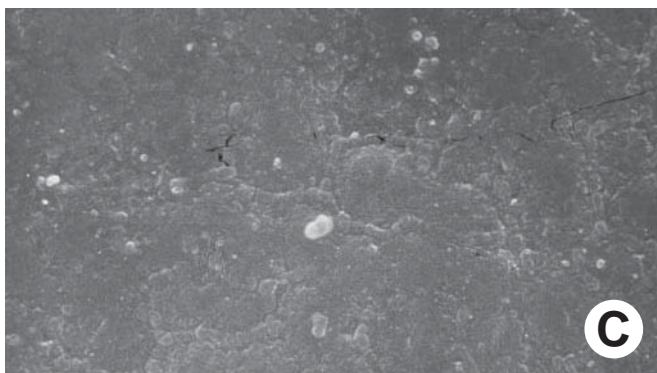
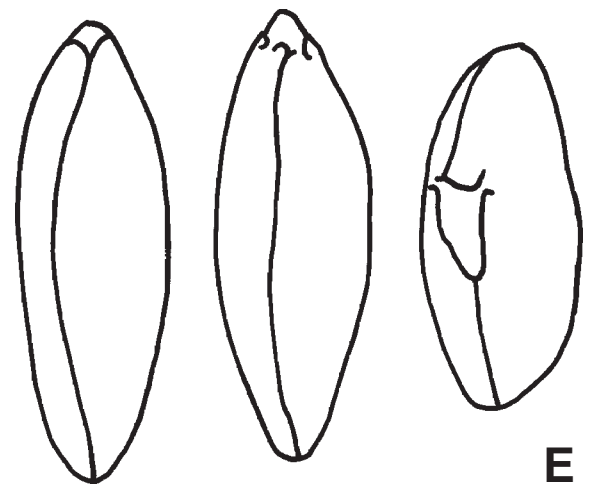
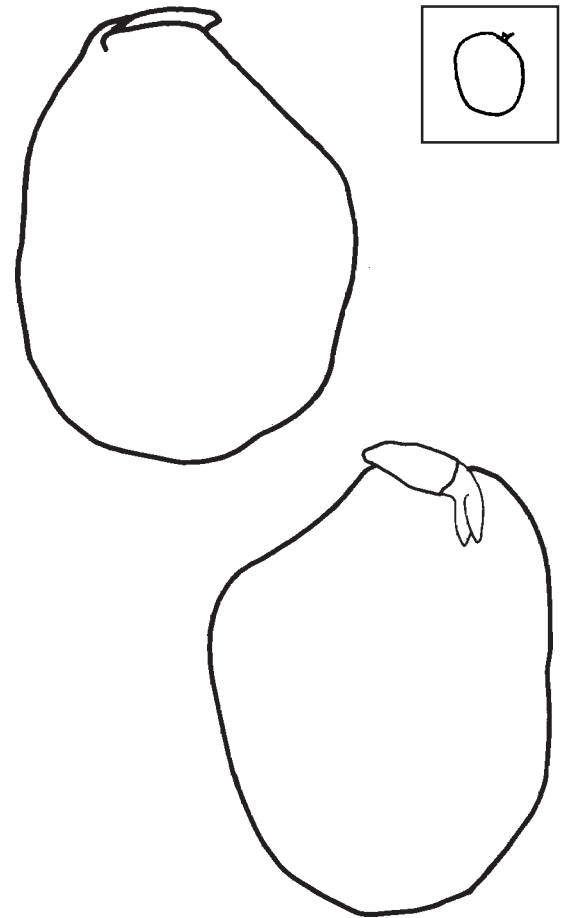
Species Studied—Species in Genus: 2 spp.—5 spp.

Fruit a legume; unilocular; $6-18 \times 1.3-2 \times 0.3-0.5$ cm; with deciduous calyx; without orifice formed by curving of fruit or fruit segments; straight to curved (slightly); not plicate; not twisted; asymmetrical or symmetrical; linear or falcate; when asymmetrical with both sutures parallelly curved; not inflated; compressed; without or with beak; straight or declined; with solid beak the same color and texture as fruit; apex aligned or oblique with longitudinal axis of fruit; tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous; seed chambers externally visible or invisible; with the raised seed chambers not torulose. Fruit margin not constricted; without sulcus; plain. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome; brown; pubescent and indurate; with 1 type of pubescence; puberulent or velutinous; with pubescence golden to white; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; not smooth; with elevated features; veined or not veined; irregularly veined; not tuberculate; scurfy; not exfoliating; with or without cracks; cracking oblique to fruit length. Mesocarp thin; 2- or 3-layered; without balsamic vesicles; without fibers; with solid or spongy layer over solid layer or vitreous layer or solid layer over 2 distinct solid layers; coriaceous. Endocarp dull; beneath seeds monochrome and mottled (between); tan; with mottling above and below seed chambers; with brown or gray overlay; beneath seeds smooth, scurfy, and cracked (the last two between seeds); subseptate; with septa thin (tissue paper-like), flexible; with septa eglandular; chartaceous; exfoliating in part; separating from mesocarp. Seeds 4–10; length transverse to fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; up to 2 mm long; of 1 length only; flattened; straight. Aril dry; tongue-aril; entire; covering less than 1/2 of seed; tan.

Seed $9 \times 3 \times 4$ mm; not overgrown; not angular; asymmetrical; nearly circular; compressed; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; dull; not modified by a bloom; colored; mottled; with infrequent mottles; brown; with brown (dark) overlay; glabrous; smooth; coriaceous. Fracture lines absent. Rim absent. Raphe not visible. Hilum visible; with faboid split; with the lips of the faboid split lighter colored than the rest of the hilum and therefore conspicuous; larger than punctiform; 2.5 mm long; with curved outline; elliptic; subapical to radicle tip; recessed; within rim. Hilum rim color darker than testa. Lens discernible; equal to or greater than 0.5 mm in length; 0.8 mm long; with margins straight; linear; not in groove of raphe; confluent with hilum; flush; same color as testa; brown; not within corona, halo, or rim. Endosperm trace; restricted to region of embryo; adnate to testa. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; not concealing radicle; entire over radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; tan; inner face flat; glabrous around base of radicle. Embryonic axis right angled; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; linear; lobe tip straight; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule well developed; glabrous.

Distribution: South America.

Cratylia: *C. mollis* C.F.P. von Martius ex G. Bentham (C–E), *C. spp.* (A–B). A, Fruits ($\times 0.7$); B, seeds ($\times 2.8$); C–D, testa ($\times 50$, $\times 1000$); E, embryos ($\times 5$).



Genus: *Collaea* A.-P. de Candolle

Phylogenetic Number: 10.26.

Tribe: Phaseoleae.

Subtribe: Diocleinae.

Species Studied—Species in Genus: 5 spp.—5 spp.

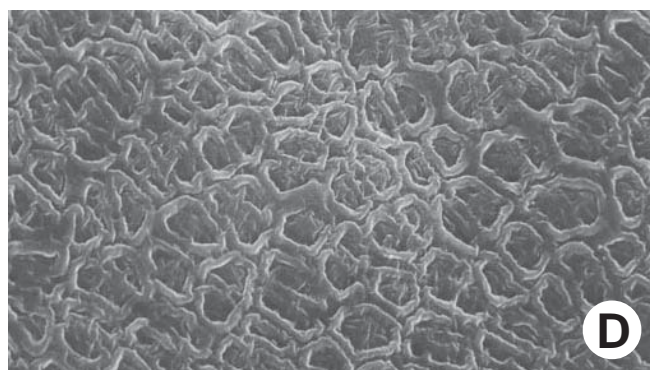
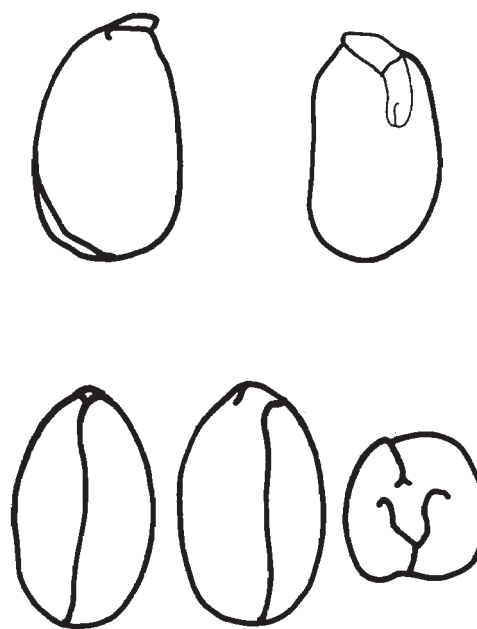
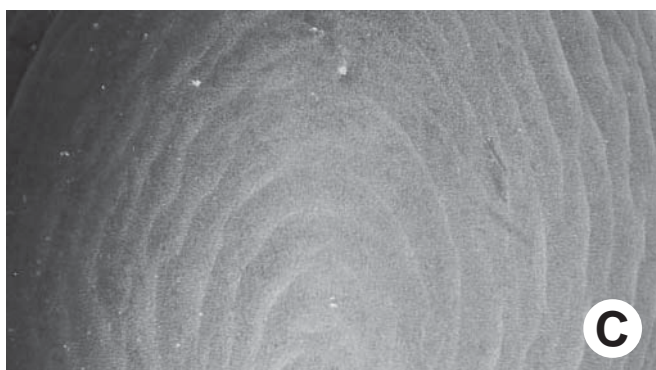
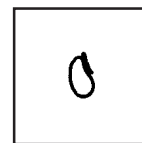
Fruit a legume; unilocular; $4.2\text{--}13 \times 0.5\text{--}1 \times 0.2\text{--}0.3$ cm; with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight or curved (slightly); not plicate; not twisted; symmetrical or asymmetrical; linear; when asymmetrical with both sutures nearly straight; not inflated; compressed; without or with beak; straight; with solid beak the same color and texture as fruit; tapered to short tapered at apex; apex oblique with longitudinal axis of fruit; tapered or short tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous; seed chambers externally visible or invisible. Fruit margin not constricted; without sulcus; plain or embellished; with thickened sutural areas. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome; brown; pubescent and indurate; with 1 type of pubescence; velutinous or sericeous; with pubescence golden or white; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; smooth; not veined; not tuberculate; not exfoliating; with cracks; cracking oblique to fruit length. Mesocarp thin; surface not veined; 2-layered; without balsamic vesicles; without fibers; with spongy layer over solid layer; coriaceous to chartaceous. Endocarp dull; mottled; brown or tan; with mottling over seed chambers; with brown overlay; scurfy; septate; with septa thicker than paper, firm; with septa eglandular; chartaceous; exfoliating in part; remaining fused to mesocarp and epicarp; entire. Seeds 6–14; length transverse to fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; up to 6 mm long; of 1 length only; flattened; triangular. Aril dry; rim-aril; entire to crenate; covering less than 1/2 of seed; without tongue (or flap-like) on lips of 2-lipped rim-aril; with 2 tongues or flaps, 1 on each lip of 2-lipped rim-aril; tan.

Seed $7\text{--}8.8 \times 5\text{--}5.8 \times 3.5\text{--}5$ mm; not overgrown; not angular; symmetrical; oblong to ovate; terete to compressed; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; dull; not modified by a bloom; colored; mottled; with frequent mottles; reddish brown; with brown (dark) overlay; glabrous; smooth; chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum visible; with faboid split; with the lips of the faboid split lighter colored than the rest of the hilum and therefore conspicuous; larger than punctiform; 4–5 mm long; with straight outline; linear; subapical to radicle tip; raised; within rim or halo. Hilum halo color darker than testa. Hilum rim color darker than testa. Lens discernible; equal to or greater than 0.5 mm in length; 0.7–1.5 mm long; with margins straight; linear; not in groove of raphe; confluent with hilum; flush; dissimilar color from testa; lighter than testa; tan; within halo. Lens halo color darker than testa. Endosperm trace; restricted to region of embryo; adnate to testa. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing radicle; split over radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; tan; inner face flat; glabrous around base of radicle. Embryonic axis right angled; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; linear; lobe tip straight; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule well developed; glabrous.

Distribution: South America.

Notes: Generic delimitation follows Burkart (1971).

Collaea: *C. speciosa* (J.L.A. Loiseleur-Deslongchamps) A.-P. de Candolle (*C-E*), *C. spp.* (*A-B*). *A*, Fruits ($\times 1.2$); *B*, seeds ($\times 4.6$); *C-D*, testa ($\times 50$, $\times 1000$); *E*, embryos ($\times 5$).



Genus: *Galactia* P. Browne

Phylogenetic Number: 10.27.

Tribe: Phaseoleae.

Subtribe: Diocleinae.

Species Studied—Species in Genus: 18 spp.—50 spp.

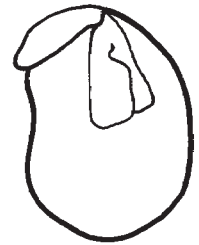
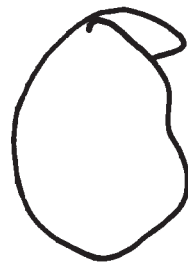
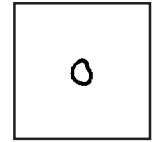
Fruit a legume; unilocular; $2.5\text{--}8 \times 0.4\text{--}1.2 \times 0.1\text{--}0.3$ cm; with persistent or deciduous calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight or curved (slightly); not plicate; not twisted; asymmetrical or symmetrical; linear or falcate; when asymmetrical with both sutures parallelly curved; not inflated; compressed or flattened; without beak; tapered or short tapered at apex; apex aligned or oblique with longitudinal axis of fruit; tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; chartaceous to coriaceous; seed chambers externally invisible or visible; with the raised seed chambers not torulose. Fruit margin not constricted; without sulcus; plain or embellished; with thickened (slightly) sutural areas. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome or multicolored; mottled; brown; with brown (darker) overlay; with mottling over seed chambers; pubescent and indurate or pubescent but soon deciduous; with 1 or 2 types of pubescence; densely tomentose, velutinous, sericeous, or tomentose and villous; with pubescence white or golden; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; smooth; not veined; not tuberculate; not exfoliating; without cracks. Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; coriaceous. Endocarp dull; monochrome; brown to tan; cracked; with hairs scattered over endocarp; subseptate; with septa thin (tissue paper-like), flexible; with septa eglandular; chartaceous; exfoliating; separating from mesocarp; entire. Seeds 5–10; length parallel or oblique to fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; up to 4 mm long; of 1 length only; filiform; curved or triangular. Aril dry; 2-lipped rim-aril; entire; covering less than 1/2 of seed; without or with tongues (or flap-like) on lips of 2-lipped rim-aril; with 2 tongues or flaps, 1 on each lip of 2-lipped rim-aril; tan.

Seed $3.5\text{--}7.8 \times 2.6\text{--}4.5 \times 1.7\text{--}3.7$ mm; not overgrown; not angular; symmetrical or asymmetrical; D-shaped, elliptic, ovate, or reniform; terete or compressed; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; dull; not modified by a bloom; colored; monochrome or mottled; with frequent or infrequent mottles; brown, orange (brownish), or tan; with brown or tan overlay; glabrous; smooth; chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum visible; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 1–4.5 mm long; with curved or straight outline; elliptic; linear; apical according to radicle tip but marginal according to seed length; raised; within rim. Hilum rim color of or darker than testa. Lens discernible; equal to or greater than 0.5 mm in length; up to 0.7 mm long; with margins straight; linear; not in groove of raphe; confluent with hilum; flush; similar color as testa; darker than testa; brown or red; within halo. Lens halo color of or darker than testa. Endosperm trace; restricted to region of embryo; adnate to testa. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire or not entire 180 degrees from base of radicle; slightly notched; similar at apex; partially concealing radicle; split over radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; white; inner face flat; glabrous around base of radicle. Embryonic axis right angled; oblique or perpendicular to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; linear or triangular; lobe tip curved; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule well developed; glabrous.

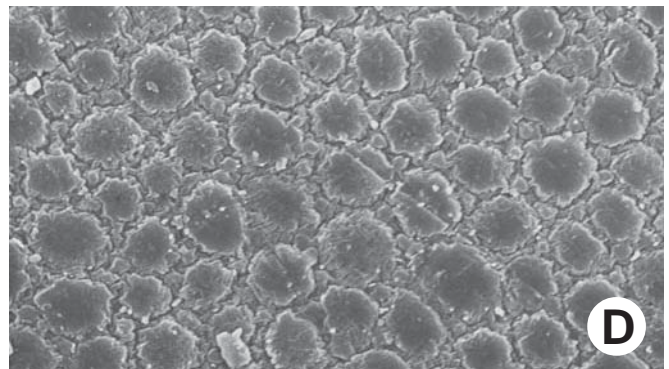
Distribution: Pantropics, pansubtropics, and temperate southern United States.

Notes: Burkart (1971) monographed the *Galactia* species of South America.

Galactia: *G. jussiaeana* K.S. Kunth (C–E), *G. spp.* (A–B). A, Fruits ($\times 1.4$); B, seeds ($\times 3.4$); C–D, testa ($\times 50$, $\times 1000$); E, embryos ($\times 8$).



E



Genus: *Herpyza* C. Wright

Phylogenetic Number: 10.28.

Tribe: Phaseoleae.

Subtribe: Diocleinae.

Species Studied—Species in Genus: 1 sp.—1 sp.

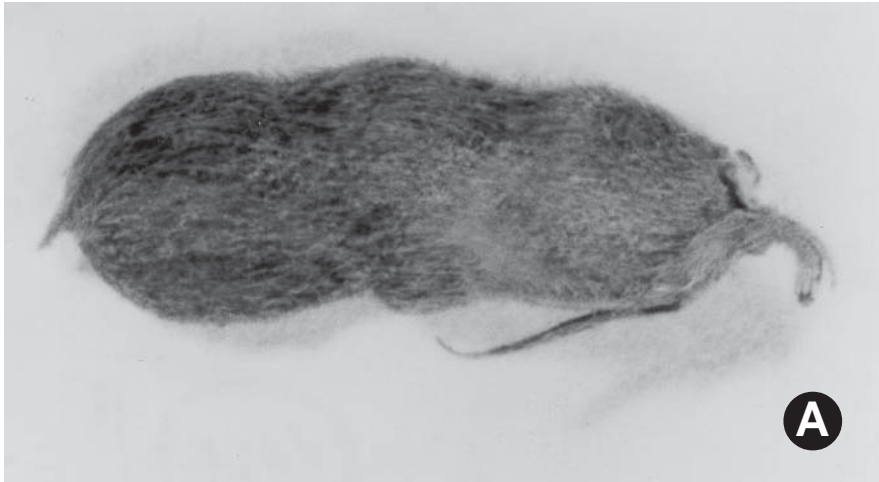
Fruit a legume; unilocular; with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; symmetrical; linear; not inflated; compressed; with beak; straight; with solid beak the same color and texture as fruit; apex oblique with longitudinal axis of fruit; short tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture. Fruit margin not constricted; without sulcus; plain. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Epicarp dull; multicolored; mottled; green; with brown overlay; assumed pubescent and indurate; with 2 types of pubescence; puberulent; with pubescence golden; with pubescence uniformly distributed; with simple hairs; stiff; with hair bases plain; eglandular; without spines; not tuberculate. Endocarp septate (from Lewis); with septa eglandular. Seeds 1, 2, or 3 (from Lewis).

Distribution: Cuba.

Notes: Lackey (1981b) noted that *Herpyza* is “very poorly known.” Lewis (1988) published fruit-seed illustrations that were drawn from the type: “1865, Wright 2325 (Royal Botanic Gardens, Kew).” Urban (1908) also published a fruit-seed illustration. A single immature fruit of *H. grandiflora* C. Wright was studied.

Herpyza: *H. grandiflora* C. Wright (A–B). A, Fruit ($\times 6.2$); B, seed ($\times 8.8$).

0



Genus: *Eminia* P.H.W. Taubert

Phylogenetic Number: 10.29.

Tribe: Phaseoleae.

Subtribe: Glycininae.

Species Studied—Species in Genus: 2 spp.—5 spp.

Fruit a legume; unilocular; $2.3\text{--}2.8 \times 0.7\text{--}1 \times 0.5$ cm; with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; asymmetrical; lanceolate or linear; when asymmetrical with both sutures nearly straight; not inflated; compressed; without or with beak; straight or declined; with solid beak the same color and texture as fruit; tapered at apex; apex aligned or oblique with longitudinal axis of fruit; tapered or rounded at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous; seed chambers externally invisible. Fruit margin not constricted; without sulcus; plain. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscent; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome; tan to brown; pubescent and indurate; with 1 type of pubescence; sericeous; with pubescence golden or white; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; smooth; not veined; not tuberculate; not exfoliating or exfoliating in part (rarely); without cracks. Mesocarp thin; 2-layered; without balsamic vesicles; without fibers; with vitreous layer or spongy layer over solid layer; coriaceous. Endocarp dull; mottled or bichrome; white or white and brown (over seed chambers); with mottling over seed chambers; with yellow overlay; smooth; subseptate; with septa thin (tissue paper-like), flexible; with septa eglandular; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 1–2; length oblique or transverse to fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; 1.5–3 mm long; of 1 length only; flattened; straight or triangular. Aril dry; rim- and tongue-aril; entire; cream.

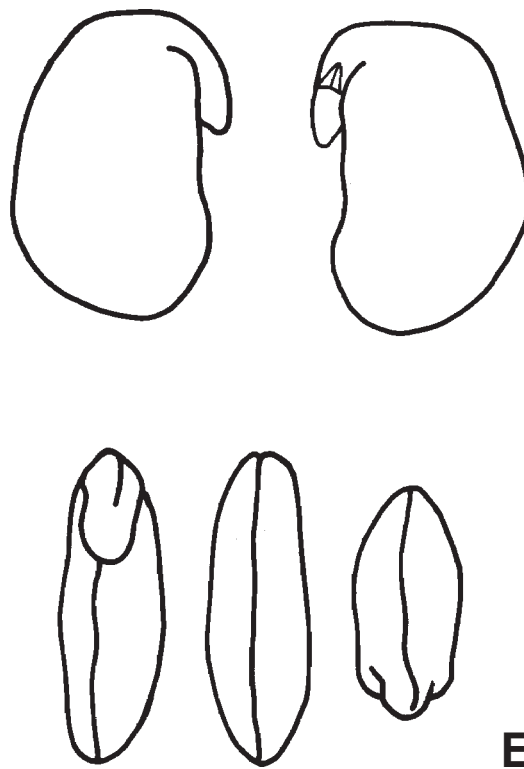
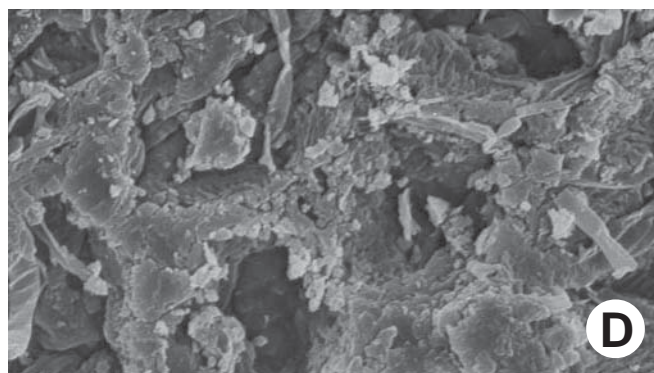
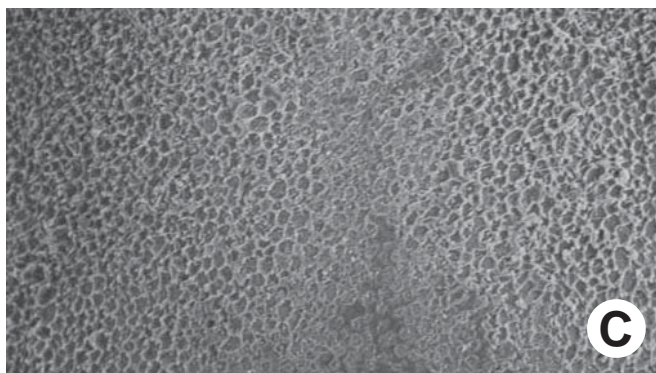
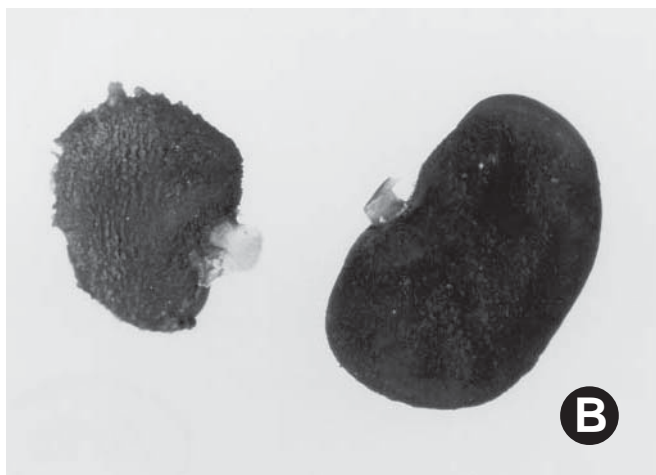
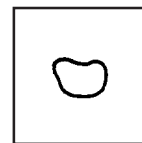
Seed $8.5\text{--}9.5 \times 6.5\text{--}7.5 \times 3\text{--}3.2$ mm; not overgrown; not angular; asymmetrical; irregularly reniform; compressed; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; dull; not

modified by a bloom; colored; monochrome; reddish brown; glabrous; not smooth; with recessed features or recessed and elevated features; wrinkled; pitted with small separate pits; chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum partially concealed; concealed by aril; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 1.3–1.5 mm long; with curved outline; elliptic; marginal according to radicle tip; recessed; within halo. Hilum halo color darker than testa. Lens discernible; less than 0.5 mm or equal to or greater than 0.5 mm in length; up to 1 mm long; with margins curved; elliptic; not in groove of raphe; confluent with hilum; flush; similar color as testa; darker than testa; not within corona, halo, or rim. Endosperm absent. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing radicle; notched at radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; yellow; inner face flat; glabrous around base of radicle. Embryonic axis straight; parallel to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; triangular; lobe tip straight; deflexed and parallel to cotyledon length; centered between cotyledons; less than 1/2 length of cotyledons. Plumule moderately developed; glabrous.

Distribution: Southern tropical Africa.

Notes: Pauwels (1983) revised the genus and accepted four species. We used his geographic distribution but Lackey's (1981b) species count.

Eminia: *E. antennulifera* (J.G. Baker) P.H.W. Taubert (C–E), *E. spp.* (A–B). A, Fruits ($\times 2.1$); B, seeds ($\times 5.9$); C–D, testa ($\times 50$, $\times 1000$); E, embryos ($\times 5$).



Genus: *Pseudeminia* B. Verdcourt

Phylogenetic Number: 10.30.

Tribe: Phaseoleae.

Subtribe: Glycininae.

Species Studied—Species in Genus: 2 spp.—4 spp.

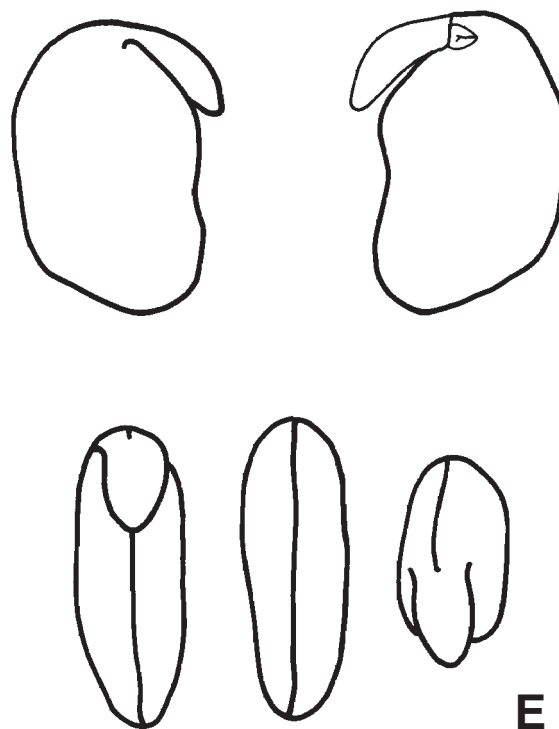
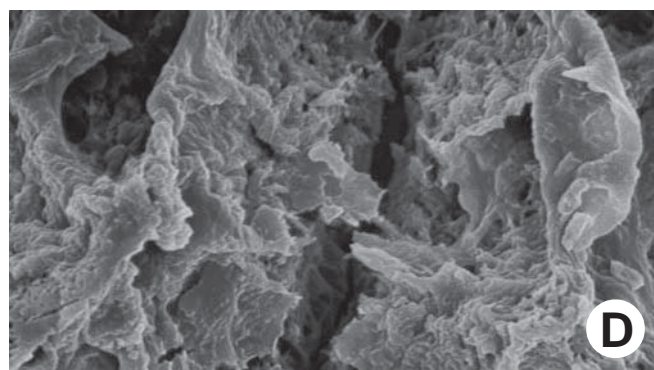
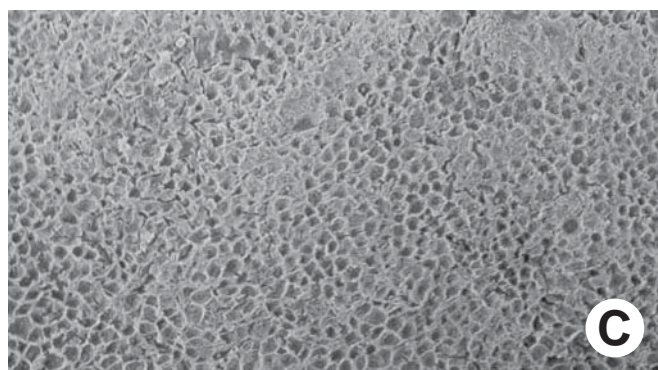
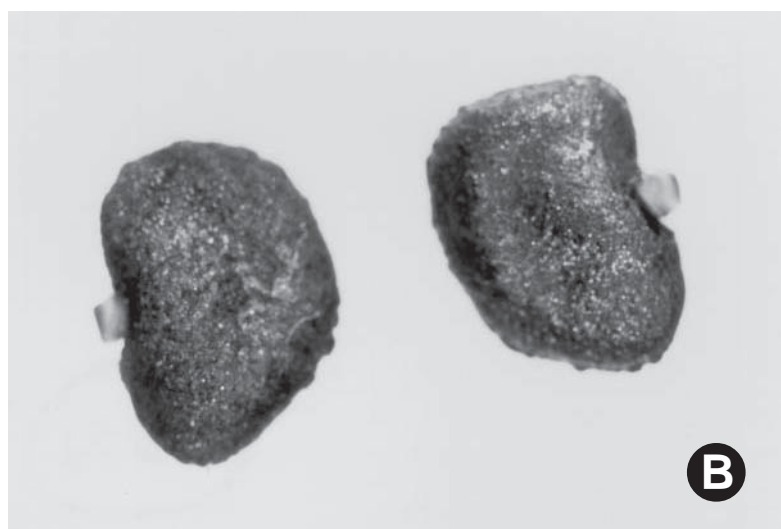
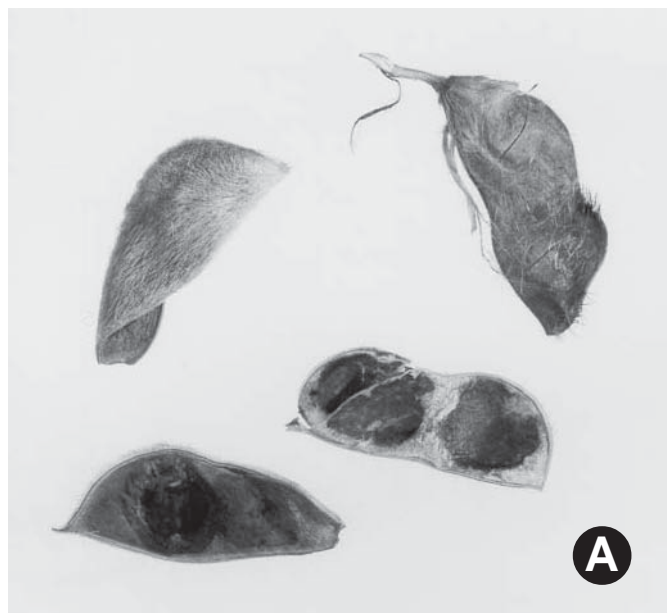
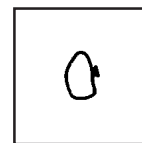
Fruit a legume; unilocular; $1.8\text{--}2.5 \times 0.7\text{--}0.9 \times 0.3\text{--}0.5$ cm; with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; asymmetrical; when asymmetrical with 1 straight and 1 curved suture; slightly narrowest near middle, B-shaped; not inflated; compressed; with beak (short); straight; with solid beak the same color and texture as fruit; tapered or short tapered at apex; apex aligned or oblique with longitudinal axis of fruit; short tapered at base; base oblique with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous; seed chambers externally visible; with the raised seed chambers not torulose. Fruit margin slightly constricted along both margins; without sulcus; plain. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome; brown; pubescent and indurate; with 1 type of pubescence; sericeous; with pubescence golden or gray; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; smooth; not veined; not tuberculate; not exfoliating; without cracks. Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; coriaceous. Endocarp dull; mottled; tan; with mottling over seed chambers; with brown overlay; scurfy and smooth; subseptate; with septa thin (tissue paper-like), flexible; with septa eglandular; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 2; length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; 0.5–1 mm long; of 1 length only; flattened; straight. Aril dry; rim- and tongue-aril; entire; cream.

Seed $6.5\text{--}9.5 \times 5\text{--}7 \times 3\text{--}3.7$ mm; not overgrown; not angular; asymmetrical; irregularly reniform; compressed; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; dull; not modified by a bloom; colored; mottled; with frequent

mottles; brown; with black overlay; glabrous; not smooth; with elevated features; rugose; coriaceous. Fracture lines absent. Rim absent. Raphe from hilum through lens and base of seed to point opposite hilum; not bifurcating; darker than testa; black; raised. Hilum partially concealed; concealed by aril; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 1–1.6 mm long; with curved outline; elliptic; apical according to radicle tip but marginal according to seed length; recessed; within corona or not within corona, halo, or rim. Hilum corona color lighter than testa. Lens discernible; equal to or greater than 0.5 mm in length; up to 1.4 mm long; with margins straight; linear; not in groove of raphe; confluent with hilum; flush; similar color as testa; darker than testa; dark brown; within corona or not within corona, halo, or rim. Lens corona color darker than testa. Endosperm trace; restricted to region of embryo; adnate to testa. Cotyledons not smooth; 1–3 grooves on each face; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing radicle; notched at radicle; without lobes; with the interface division terminating at base of radicle; with 1 margin recessed; recessed on same side as radicle; pale yellow; inner face flat; glabrous around base of radicle. Embryonic axis oblique; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; bulbous; lobe tip curved; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule moderately developed; glabrous.

Distribution: Tropical Africa.

Pseudeminia: *P. comosa* (J.G. Baker) B. Verdcourt (A–E). A, Fruits ($\times 1.8$); B, seeds ($\times 6.8$); C–D, testa ($\times 50$, $\times 1000$); E, embryos ($\times 5$).



Genus: *Pseudovigna* (H.A.T. Harms) B. Verdcourt

Phylogenetic Number: 10.31.

Tribe: Phaseoleae.

Subtribe: Glycininae.

Species Studied—Species in Genus: 1 sp.—2 spp.

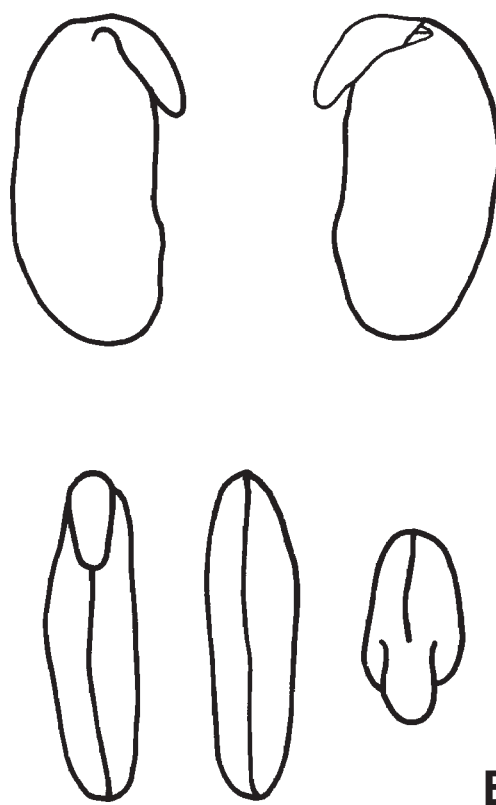
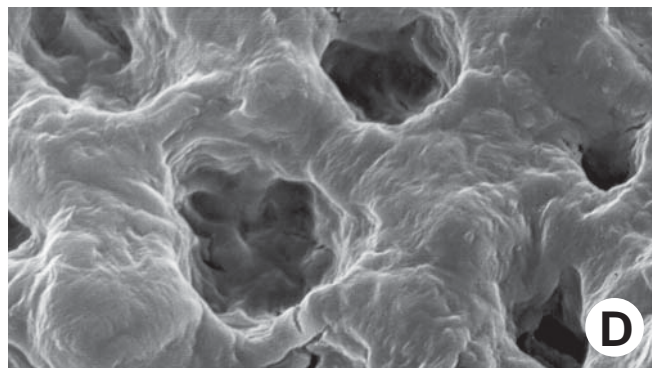
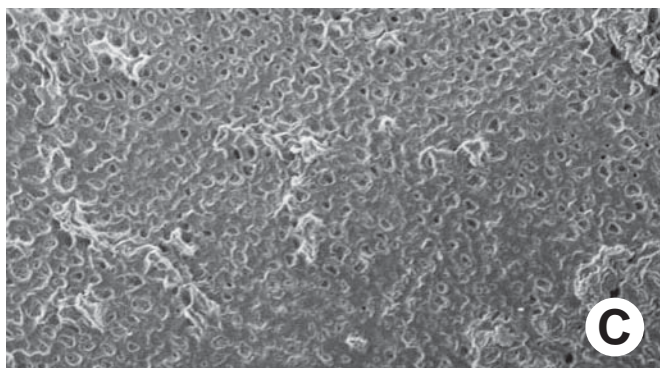
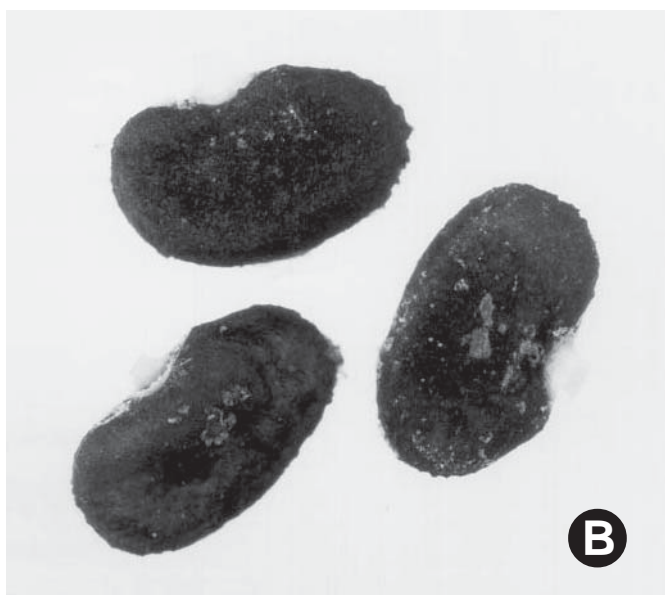
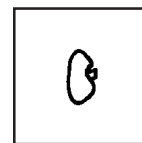
Fruit a legume; unilocular; $2.2\text{--}3.2 \times 0.7\text{--}0.8 \times 0.4$ cm; with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; symmetrical; oblong; not inflated; compressed; with beak (short); declined; with solid beak the same color and texture as fruit; blunt at apex; apex oblique with longitudinal axis of fruit; tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous; seed chambers externally visible; with the raised seed chambers not torulose. Fruit margin not constricted; without sulcus; plain. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome; brown; pubescent and indurate; with 3 types of pubescence; tomentose; with pubescence white and brown; with long appressed brown hairs and short and shorter white hairs intermixed; with pubescence uniformly distributed; with simple hairs; stiff and pliable; with hair bases swollen and plain; eglandular; without spines; not smooth; with elevated features; not veined; not tuberculate; rugose; not exfoliating; without cracks. Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; coriaceous. Endocarp dull; monochrome; tan; fibrous; septate; with septa thin (tissue paper-like), flexible; with septa eglandular; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 1–3; length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; $0.5\text{--}0.7$ mm long; of 1 length only; flattened; straight. Aril dry; rim- and tongue-aril or 2-lipped rim-aril; fimbriate or entire; with tongues (or flap-like) on lips of 2-lipped rim-aril; with 2 tongues or flaps, 1 on each lip of 2-lipped rim-aril; cream.

Seed $6.1\text{--}10.5 \times 4.4\text{--}6.3 \times 2.8\text{--}3.5$ mm; not overgrown; not angular; symmetrical or asymmetrical; regularly to irregularly reniform; compressed; with surface smooth; without visible radicle and cotyledon lobes; without

hilar sinus; without umbo on seed faces. Testa not adhering or partially adhering to endocarp; dull; not modified by a bloom; colored; monochrome; brown; glabrous; not smooth; with elevated features; reticulate; coriaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible or visible; from hilum to near base of seed and terminating; not bifurcating; color of testa; raised. Hilum partially concealed; concealed by aril; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; $1.6\text{--}2.6$ mm long; with curved outline; elliptic; apical according to radicle tip but marginal according to seed length; recessed; within corona or not within corona, halo, or rim. Hilum corona color darker than testa. Lens discernible; equal to or greater than 0.5 mm in length; up to 1 mm long; with margins straight; linear; not in groove of raphe; confluent with hilum; flush; similar color as testa; darker than testa; dark brown; within corona or not within corona, halo, or rim. Lens corona color darker than testa. Endosperm trace; restricted to region of embryo; adnate to testa. Cotyledons not smooth; 1–3 grooves on each face; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing radicle; notched at radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; white; inner face flat; glabrous around base of radicle. Embryonic axis oblique; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; bulbous; lobe tip curved; oblique to cotyledons; centered between cotyledons; less than $1/2$ length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Tropical and western Africa.

Pseudovigna: *P. argentea* (C.L. von Willdenow) B. Verdcourt (A–E). A, Fruits ($\times 2.5$); B, seeds ($\times 6.2$); C–D, testa ($\times 50$, $\times 1000$); E, embryos ($\times 5$).



Genus: *Pueraria* A.-P. de Candolle

Phylogenetic Number: 10.32.

Tribe: Phaseoleae.

Subtribe: Glycininae.

Species Studied—Species in Genus: 7 spp.—16 spp.

Fruit a legume; unilocular; $1.5\text{--}13 \times 0.3\text{--}1.2 \times 0.3\text{--}0.5$ cm; with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight or curved (slightly); not plicate; not twisted; symmetrical or asymmetrical; linear, moniliform, or falcate; when asymmetrical with 1 straight and 1 curved suture or both sutures parallelly curved; narrowest near middle, B-shaped; not inflated; flattened or compressed; with beak; straight; with solid beak the same color and texture as fruit; long tapered, tapered, short tapered, or rounded at apex; apex aligned or oblique with longitudinal axis of fruit; tapered, short tapered, or rounded at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; chartaceous or coriaceous; seed chambers externally visible or invisible; with the raised seed chambers not torulose. Fruit margin not constricted or constricted; slightly constricted along both margins or only on 1 margin; without sulcus; plain or embellished; with thickened sutural areas. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome; black or brown; glabrous or pubescent and indurate; with hairs erect or appressed; with 1 or 2 types of pubescence; pilose, puberulent, or velutinous; with pubescence brown; with pubescence uniformly distributed; with simple hairs or simple and complex hairs; with bristle-like hairs; pliable; with hair bases swollen or plain; retrorse and straight; straight at apex; eglandular; without spines; smooth or not smooth; with elevated features; veined or not veined; irregularly veined; not tuberculate; striate or wrinkled; not exfoliating; without cracks. Mesocarp present or absent; thin; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; coriaceous to chartaceous. Endocarp dull to glossy; monochrome; tan; smooth; septate to nonseptate; with septa thin (tissue paperlike), flexible; with septa eglandular; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp or separating from mesocarp (partially); remaining fused to epicarp; entire.

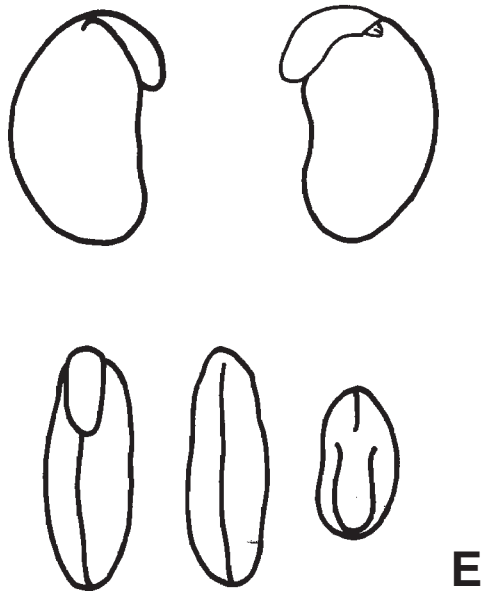
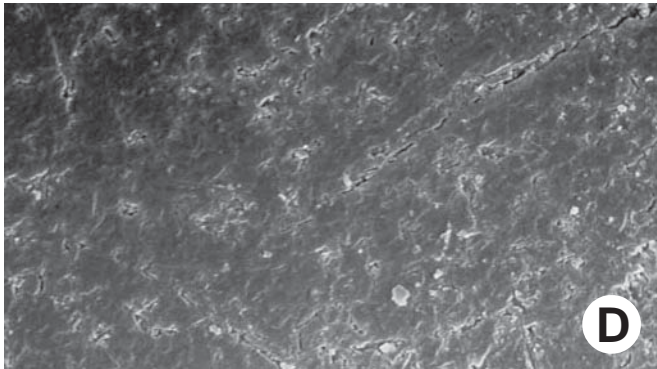
Seeds (1–)5–20; length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; up to 1 mm long; of 1 length only; flattened; triangular. Aril dry; rim-aril or rim- and tongue-aril; entire; cream.

Seed 2–3 or 7–9 \times ca. 1.5 or 5–6 \times 1 or 2.5–3 mm; not overgrown; not angular; symmetrical or asymmetrical; oblong or reniform (irregularly); terete to compressed; with surface smooth; with (slightly) or without visible radicle and cotyledon lobes; without external groove between radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering or partially adhering to endocarp; dull; not modified by a bloom; colored; monochrome or mottled; with frequent mottles; black or brown; with black overlay; glabrous; smooth or not smooth; with elevated or recessed features; minutely tuberculate; pitted with small separate pits; chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum partially concealed; concealed by aril; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 0.6–1.5 mm long; with curved outline; circular to elliptic to oval; marginal according to radicle tip; recessed; within rim. Hilum rim color darker than testa. Lens discernible; equal to or greater than 0.5 mm in length; up to 1.7 mm long; with margins straight; linear; not in groove of raphe; confluent with hilum; recessed; similar color as testa; darker than testa; brown; within corona. Lens corona color darker than testa. Endosperm thick to trace; covering entire embryo or restricted to region of embryo; adnate to testa or embryo. Cotyledons not smooth; 1–3 grooves on each face; outer face of 1 cotyledon flat and other cotyledon convex or both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing radicle; notched at radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; white to yellow to green; inner face flat; glabrous around base of radicle. Embryonic axis oblique; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; bulbous or triangular; lobe tip straight; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Asia and two species widely distributed in the subtropics.

Notes: Van der Maesen (1985, 1994) monographed *Pueraria*, and his species number is used, not the 20 species of Lackey (1981b).

Pueraria: *P. montana* (J. de Loureiro) E.D. Merrill var.
lobata (C.L. von Willdenow) L.J.G. Maesen & S.
Almeida (*C-E*), *P. spp.* (*A-B*). *A*, Fruits ($\times 1$); *B*, seeds
($\times 6.4$); *C-D*, testa ($\times 50$, $\times 1000$); *E*, embryos ($\times 6$).



Genus: *Nogra* E.D. Merrill

Phylogenetic Number: 10.33.

Tribe: Phaseoleae.

Subtribe: Glycininae.

Species Studied—Species in Genus: 1 sp.—3 spp.

Fruit a legume; unilocular; $5.5\text{--}6 \times 0.6 \times 0.3\text{--}0.4$ cm; with deciduous calyx; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; symmetrical; linear; not inflated; compressed; with beak; straight; with solid beak the same color and texture as fruit; short tapered at apex; apex aligned with longitudinal axis of fruit; tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous; seed chambers externally visible (slightly). Fruit margin not constricted; without sulcus; plain. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome; tan; pubescent and indurate; with 1 type of pubescence; pilose; with pubescence brown; with pubescence uniformly distributed; with simple hairs; stiff; with hair bases swollen; eglandular; without spines; not smooth; with elevated features; not veined; not tuberculate; papillose (associated with hairs); not exfoliating; without cracks. Mesocarp thin; 1-layered; without balsamic vesicles; without fibers; solid; coriaceous. Endocarp dull; monochrome; tan; smooth; septate; with septa thin (tissue paper-like), flexible; with septa eglandular; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 9–10; length oblique to fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; 1 mm long; of 1 length only; flattened; triangular. Aril dry; rim- and tongue-aril; entire; cream.

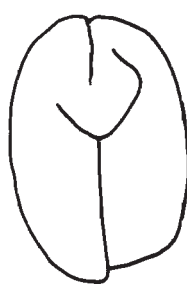
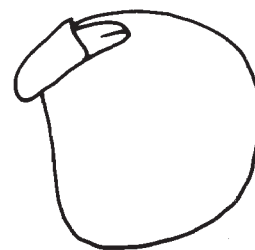
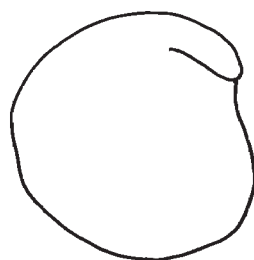
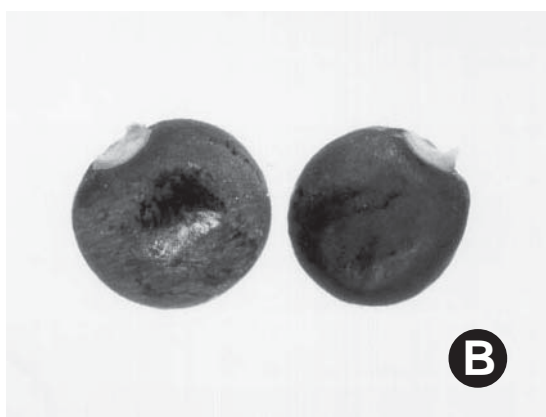
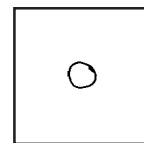
Seed $4.9 \times 4.3 \times 2.8$ mm; not overgrown; not angular; asymmetrical; nearly, irregularly circular; compressed; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; with umbo on seed faces. Testa not adhering to endocarp; dull; not modified by a bloom; colored; monochrome; reddish brown; glabrous; not smooth; with elevated features; powdery and not rubbing off; chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe from hilum through lens and base of seed to point opposite hilum; not

bifurcating; color of testa; flush. Hilum fully concealed; concealed by funicular remnant and aril; without faboid split; larger than punctiform; 1.2 mm long; with curved outline; elliptic; marginal according to radicle tip; flush; within halo. Hilum halo color darker than testa. Lens discernible; equal to or greater than 0.5 mm in length; 0.5 mm long; with margins straight; linear; not in groove of raphe; confluent with hilum; flush; similar color as testa; darker than testa; not within corona, halo, or rim. Endosperm trace; restricted to region of embryo; adnate to testa. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing radicle; notched at radicle; without lobes; with the interface division terminating at base of radicle; with 1 margin recessed; recessed on same side as radicle; orange; inner face flat; glabrous around base of radicle. Embryonic axis oblique; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; triangular; lobe tip straight; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule well developed; glabrous.

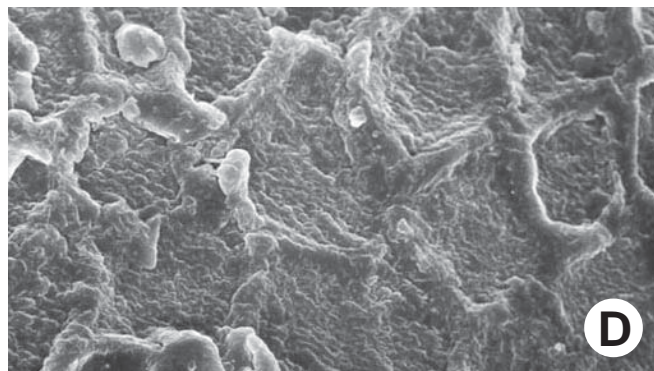
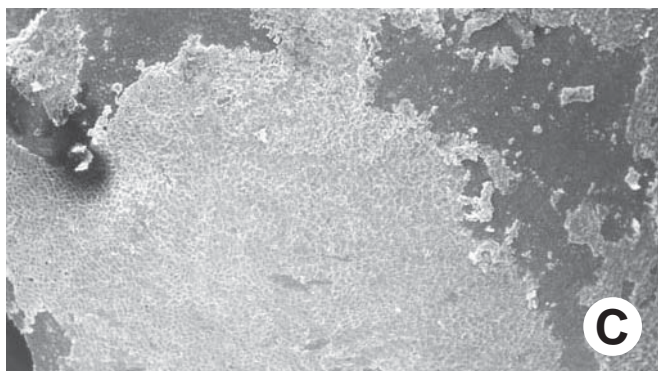
Distribution: Asia.

Notes: Lackey (1981b) noted that *Nogra filicaulis* (Kurz) E.D. Merrill “is surely not congeneric” with *N. grahamii* Merrill and *N. dalzellii* (Baker) E.D. Merrill which have a “superficial similarity, but probably represent independent lines arising from a *Pueraria*-like stock.”

Nogra: *N. dalzellii* (E.G. Baker) E.D. Merrill (A–E). A, Fruits ($\times 1.9$); B, seeds ($\times 8.4$); C–D, testa ($\times 50$, $\times 1000$); E, embryos ($\times 10$).



E



Genus: *Sinodolichos* B. Verdcourt

Phylogenetic Number: 10.34.

Tribe: Phaseoleae.

Subtribe: Glycininae.

Species Studied—Species in Genus: 1 sp.—2 spp.

Fruit a legume; unilocular; $5-6 \times 0.6-0.75 \times 0.3-0.4$ cm; with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight to curved (slightly); not plicate; not twisted; symmetrical to asymmetrical (slightly); linear, moniliform, or falcate (slightly); when asymmetrical with both sutures parallelly curved; not inflated; compressed; without beak; short tapered to rounded at apex; apex aligned with longitudinal axis of fruit; short tapered to rounded at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous; seed chambers externally invisible. Fruit margin not constricted; without sulcus; plain. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscent; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome; dark brown; pubescent and indurate; with 2 types of pubescence; sericeous; with pubescence golden; with pubescence uniformly distributed; with simple and complex hairs; with bristle-like hairs; pliable; with hair bases plain; straight; straight at apex; glandular; with glandular dots; without spines; smooth or not smooth; with elevated features; not veined; not tuberculate; glandular dotted and papillose; not exfoliating; without cracks. Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; chartaceous. Endocarp dull; mottled; brown; with mottling over seed chambers; with brown and tan overlay; scurfy and floury-filamentous; with hairs scattered over endocarp; septate; with septa thin (tissue paper-like), flexible; with septa eglandular; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 7–10; length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; 0.5–0.7 mm long; of 1 length only; flattened; triangular. Aril dry; rim- and tongue-aril; entire; cream.

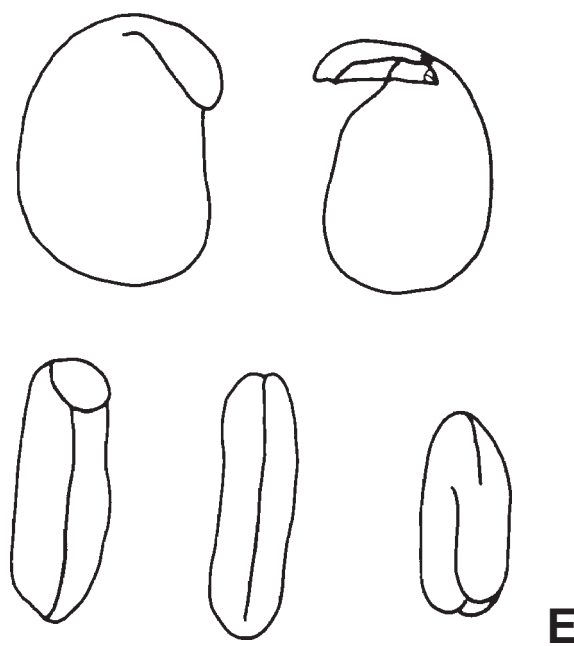
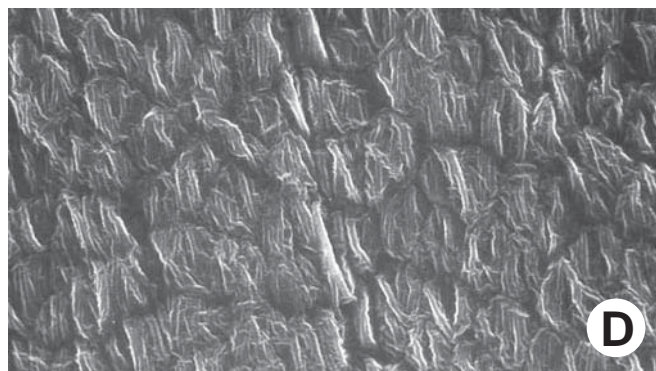
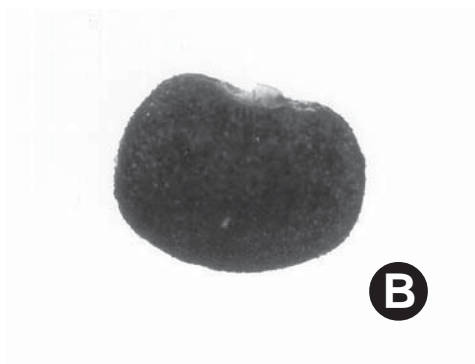
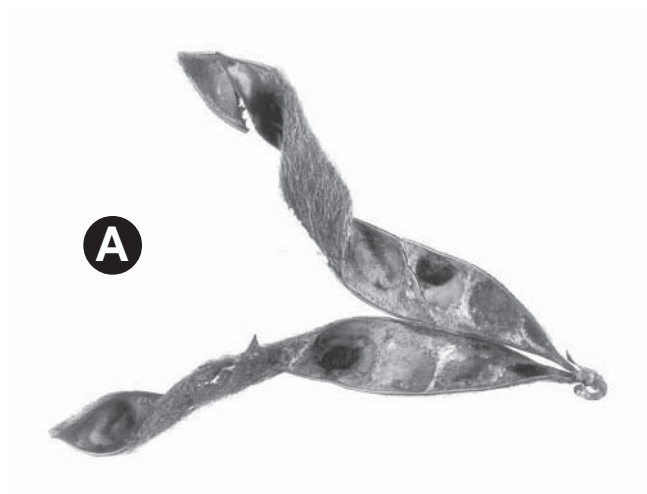
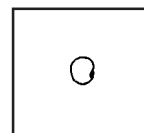
Seed $4-5.8 \times 2.9-4.6 \times 2-2.4$ mm; not overgrown; not angular; symmetrical or asymmetrical; regularly or irregularly reniform; compressed; with surface smooth;

without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering or partially adhering to endocarp; dull; not modified by a bloom; colored; mottled; with frequent mottles; reddish brown; with brown (dark) overlay; glabrous; not smooth; with elevated features; reticulate; coriaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum partially concealed; concealed by aril; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 1.7–1.9 mm long; with curved outline; elliptic; apical according to radicle tip but marginal according to seed length; recessed; within corona. Hilum corona color darker than testa. Lens discernible; less than 0.5 mm to equal to or greater than 0.5 mm in length; ca. 0.5 mm long; with margins straight; linear; not in groove of raphe; confluent with hilum; flush; similar color as testa; darker than testa; brown; within corona. Lens corona color darker than testa. Endosperm thin; covering entire embryo; adnate to testa. Cotyledons not smooth; 1–3 grooves on each face; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; not concealing radicle; notched at radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; yellow; inner face flat; glabrous around base of radicle. Embryonic axis oblique; perpendicular to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; bulbous; lobe tip curved; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Asia.

Notes: Lackey (1981b) noted, “a poorly known genus. It is possibly congeneric with *Glycine*” (10.35). Their fruits and seeds are similar.

Sinodolichos: *S. lagopus* (S.T. Dunn) B. Verdcourt (A–E). A, Fruits ($\times 1$); B, seed ($\times 8.3$); C–D, testa ($\times 50$, $\times 1000$); E, embryos ($\times 11$).



Genus: *Glycine* C.L. von Willdenow

Phylogenetic Number: 10.35.

Tribe: Phaseoleae.

Subtribe: Glycininae.

Species Studied—Species in Genus: 3 spp.—9 spp.

Fruit a legume; unilocular; $1.5\text{--}7 \times 0.3\text{--}1.5 \times 0.2\text{--}0.8$ cm; without orifice formed by curving of fruit or fruit segments; straight or curved (slightly); not plicate; not twisted; asymmetrical or symmetrical; linear, falcate to moniliform (slightly), or irregular; when asymmetrical with both sutures unequally or parallelly curved; not inflated; compressed; without or with beak; straight or declined; with solid beak the same color and texture as fruit; tapered or short tapered at apex; apex aligned or oblique with longitudinal axis of fruit; tapered at base; base aligned or oblique with longitudinal axis of fruit; with the apex and base uniform in texture; chartaceous to coriaceous; seed chambers externally visible or invisible; with the raised seed chambers not torulose. Fruit margin not constricted or constricted (rarely); constricted along both margins; without sulcus; plain or embellished; with thickened sutural areas. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscent; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome; tan to brown (dark); pubescent and indurate; with 1 type of pubescence; puberulent to sericeous; with pubescence golden to gray; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases swollen or plain; eglandular; smooth; not veined or veined; irregularly veined; not tuberculate; not exfoliating; without cracks. Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; coriaceous to chartaceous. Endocarp dull; monochrome; brown to tan to white; smooth; septate or subseptate; with septa thin (tissue paper-like), flexible; with septa eglandular; chartaceous; not exfoliating or exfoliating in part; remaining fused to mesocarp and epicarp; entire. Seeds 2–8; length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus less than 0.5 mm long or measured; 0.5 mm long; of 1 length only; flattened; straight. Aril dry; rim-aril or 2-lipped rim-aril; entire; with tongues (or flap-like) on lips of 2-lipped rim-aril; with 1 tongue or flap on 1 lip of 2-lipped rim-aril; cream, tan, or white.

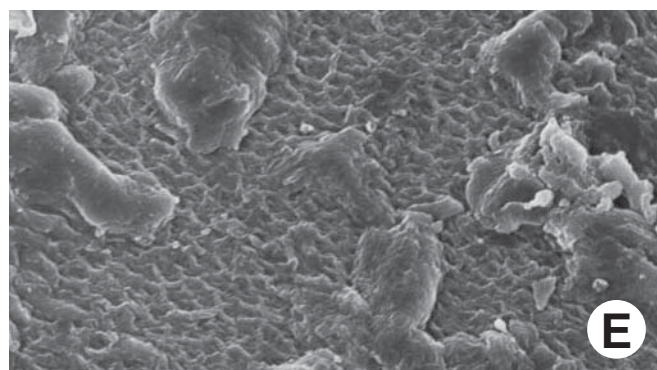
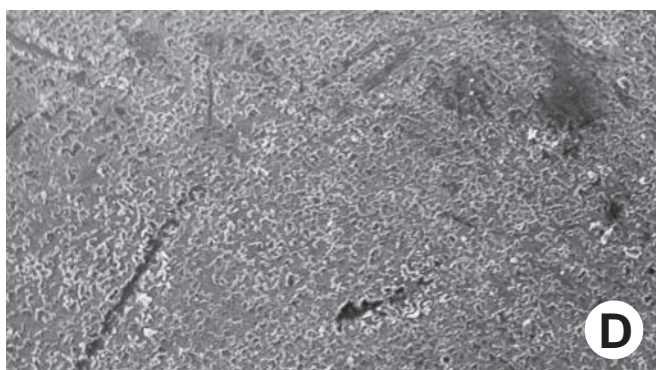
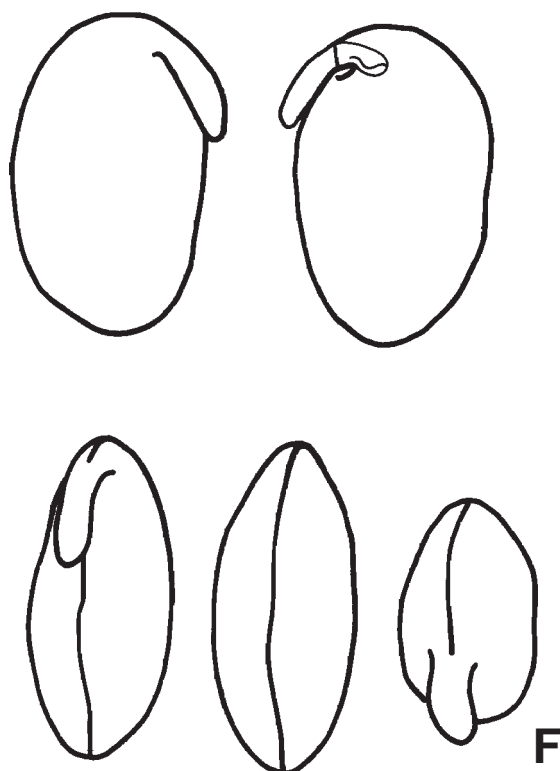
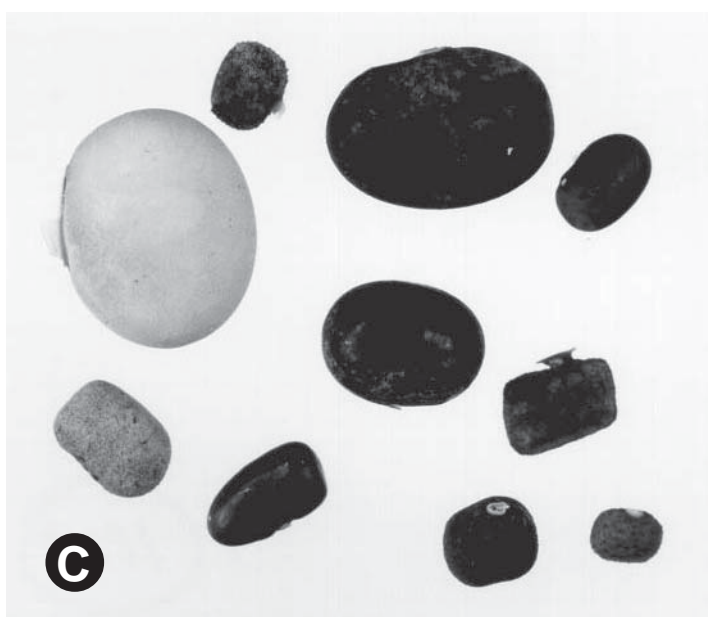
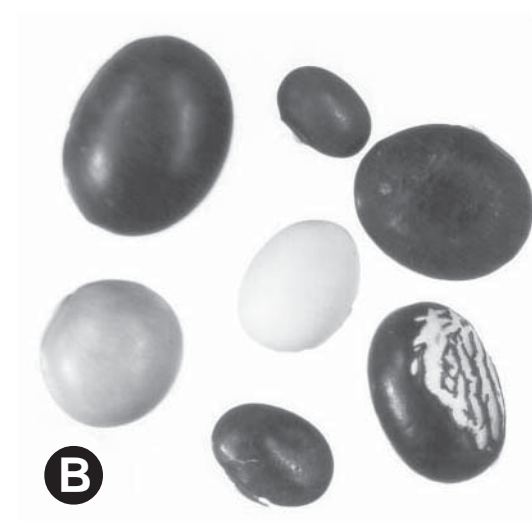
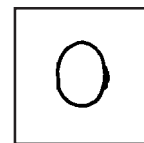
Seed $2\text{--}15.2 \times 1.8\text{--}10.2 \times 1\text{--}7$ mm; not overgrown; angular or not angular; symmetrical or asymmetrical; elliptic, oblong, ovate, quadrangular, rectangular, or reniform; compressed; with surface smooth; without or with visible radicle and cotyledon lobes; without external groove between radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; dull; not modified or modified by a bloom; colored or clear; monochrome or mottled; with frequent mottles; brown to cream to tan to yellow; with brown overlay; glabrous; not smooth or smooth; with elevated features; reticulate, tuberculate, or papillate; coriaceous to chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum partially concealed; concealed by aril; with or without faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 0.4–5.8 mm long; with curved outline; elliptic; apical according to radicle tip but marginal according to seed length; flush or recessed; within rim or corona or not within corona, halo, or rim. Hilum corona color darker than testa. Hilum rim color of testa. Lens discernible; less than 0.5 mm to equal to or greater than 0.5 mm in length; up to 1.5 mm long; with margins straight; linear; not in groove of raphe; confluent with hilum; mounded or recessed; same or similar color as testa; lighter or darker than testa; brown to tan; within rim or not within corona, halo, or rim. Lens rim color of, lighter than, or darker than testa. Endosperm thin or trace; covering entire embryo or restricted to region of embryo; adnate to testa or embryo. Cotyledons smooth or not smooth; wrinkled; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing or not concealing radicle; notched at radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; white to yellow to tan; inner face flat; glabrous around base of radicle. Embryonic axis straight to oblique; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; bulbous; lobe tip curved; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons to 1/2 to nearly length of cotyledons. Plumule well developed; glabrous.

Distribution: Asia, Australia, Oceania, and widely cultivated.

Notes: Lackey (1981b) commented that *Sinodolichos* (10.34) is possibly congeneric with *Glycine*. *Glycine*

max, the soybean, is the most valuable grain legume with a worldwide production of 123.6 million metric tons in 1995 (American Soybean Association 1997, Duke 1981, Maesen and Somaatmadja 1989, Schery 1972). Soybean is valuable because the seed is 13–25 percent oil, 30–50 percent protein, and 14–24 percent carbohydrate (Schery 1972).

Glycine: *G. max* (C. Linnaeus) E.D. Merrill (*B, D–F*), *G.*
spp. (*A, C*). *A*, Fruits ($\times 1.4$); *B–C*, seeds ($\times 2.5$,
 $\times 5.2$); *D–E*, testa ($\times 50$, $\times 1000$); *F*, embryos ($\times 3$).



Genus: *Teramnus* P. Browne

Phylogenetic Number: 10.36.

Tribe: Phaseoleae.

Subtribe: Glycininae.

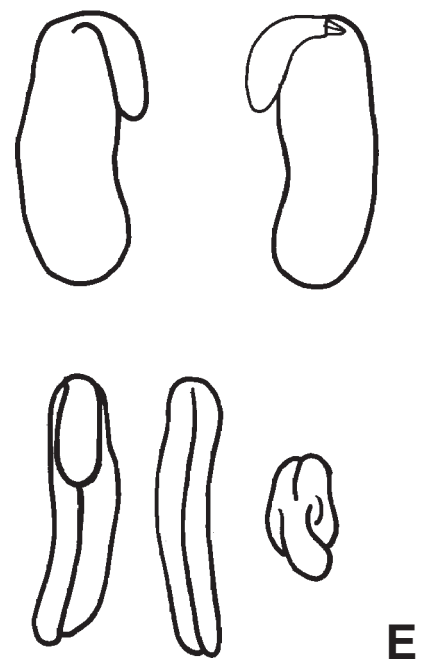
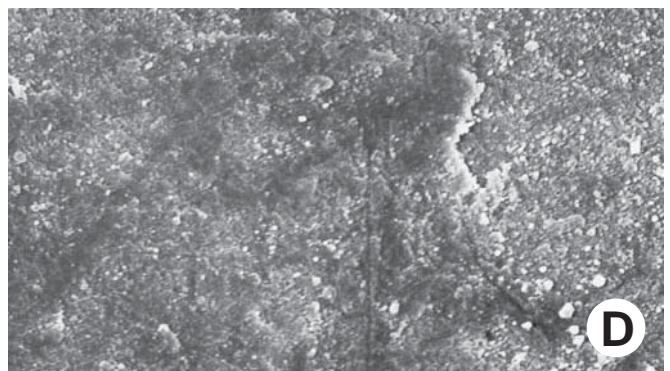
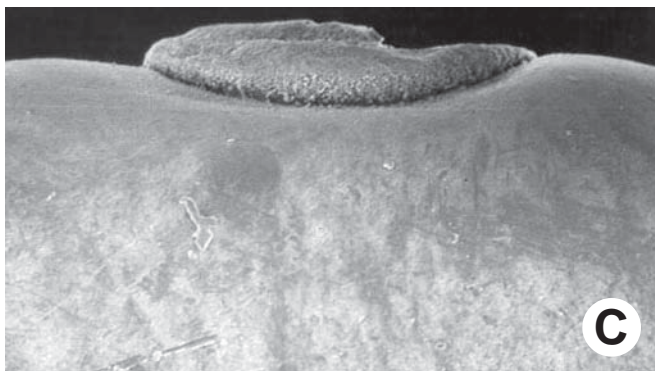
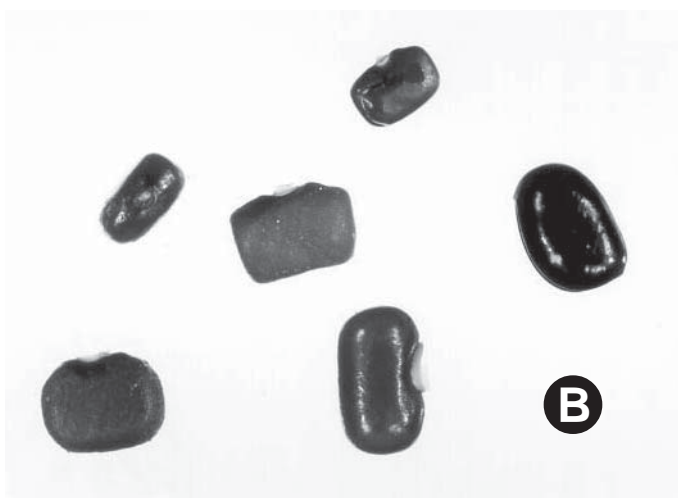
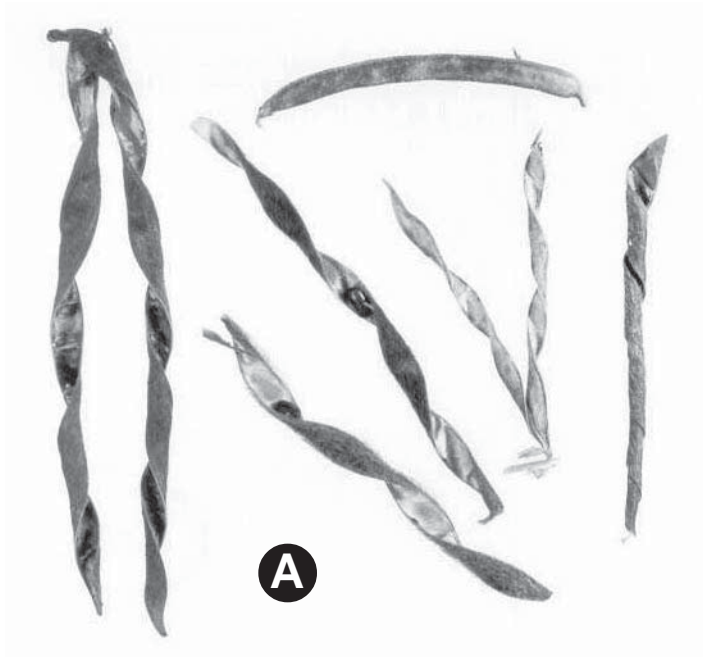
Species Studied—Species in Genus: 7 spp.—8 spp.

Fruit a legume; unilocular; $2.5\text{--}5 \times 0.2\text{--}0.4 \times 0.1\text{--}0.3$ cm; with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; symmetrical; linear; not inflated; compressed; with beak; straight; with solid beak the same color and texture as fruit; tapered at apex; apex oblique to right-angled with longitudinal axis of fruit; tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; chartaceous; seed chambers externally visible (slightly) or invisible; with the raised seed chambers not torulose. Fruit margin not constricted; without sulcus; plain or embellished; with thickened sutural areas. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome or multicolored; mottled; brown or tan; with brown overlay; with mottling over seed chambers; pubescent and indurate; with hairs erect or appressed; with 1 type of pubescence; velutinous; with pubescence golden; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; not smooth; with elevated features; not veined; not tuberculate; papillose and rugose; not exfoliating; without cracks. Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; chartaceous. Endocarp dull; monochrome; brown to tan; smooth; septate or subseptate; with septa thin (tissue paper-like), flexible; with septa eglandular; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 6–11; length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus less than 0.5 mm long; of 1 length only; flattened; triangular. Aril slightly fleshy or dry; when fleshy 2-lipped rim-aril; entire; covering less than 1/2 of seed; when dry 2-lipped rim-aril; entire; covering less than 1/2 of seed; without or with tongues (or flap-like) on lips of 2-lipped rim-aril; with 1 tongue or flap on 1 lip of 2-lipped rim-aril; cream.

Seed $2.8\text{--}5.5 \times 1.6\text{--}3.3 \times 1.2\text{--}3.3$ mm; not overgrown; not angular; symmetrical; oblong to reniform; terete to compressed; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; with umbo on seed faces. Testa not adhering to endocarp; glossy to dull or glaucous; not modified or modified by a bloom; colored; monochrome; brown; glabrous; smooth; chartaceous. Fracture lines present or absent; transverse. Rim absent. Wings absent. Raphe barely visible or not visible; from hilum through lens and base of seed to point opposite hilum; not bifurcating; lighter than testa; brown; flush. Hilum partially concealed; concealed by aril; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 0.6–1.4 mm long; with curved outline; elliptic; apical according to radicle tip but marginal according to seed length; recessed; within rim. Hilum rim color of or darker than testa. Lens discernible; less than 0.5 mm in length; with margins curved; circular; not in groove of raphe; adjacent to hilum; flush; similar color as testa; darker than testa; brown; within corona or not within corona, halo, or rim. Lens corona color darker than testa. Endosperm thick; covering entire embryo; adnate to testa or embryo. Cotyledons not smooth; 1–3 grooves on each face; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing or not concealing radicle; notched at radicle; without lobes; with the interface division terminating at base of radicle; without or with 1 margin recessed; recessed on same side as radicle; white to yellow; inner face flat; glabrous around base of radicle. Embryonic axis oblique; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; bulbous; lobe tip curved; with 90-degree turn; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary to moderately developed; glabrous.

Distribution: Pantropics.

Teramnus: *T. uncinatus* (C. Linnaeus) O.P. Swartz (*C–E*), *T. spp.* (*A–B*). *A*, Fruits ($\times 1.4$); *B*, seeds ($\times 6.2$); *C–D*, testa ($\times 50$, $\times 1000$); *E*, embryos ($\times 8$).



Genus: *Diphyllarium* F. Gagnepain

Phylogenetic Number: 10.37.

Tribe: Phaseoleae.

Subtribe: Glycininae.

Species Studied—Species in Genus: 1 sp.—1 sp.

Fruit a legume; unilocular; $6.3-8 \times 0.7 \times 0.3-4$ cm; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; slightly asymmetrical; nearly linear; when asymmetrical with both sutures nearly straight; not inflated; flattened; without beak; tapered at apex; apex oblique with longitudinal axis of fruit; tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; leathery; seed chambers externally visible (barely). Fruit margin slightly constricted along both margins; without sulcus; embellished; with ridges. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome; drying dark brown to black; glabrous; eglandular; without spines; not smooth; with elevated features; not veined; not tuberculate; slightly rugose; not exfoliating; without cracks. Mesocarp thin; 1-layered; without balsamic vesicles; without fibers; solid; coriaceous. Endocarp dull; monochrome; dark brown to black; smooth; subseptate; with septa thin (tissue paper-like), flexible; with septa eglandular; chartaceous; exfoliating in part; remaining fused to mesocarp and epicarp; entire. Seeds 7–8; length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; up to 1.5 mm long; of 1 length only; flattened; triangular. Aril dry; rim- and tongue-aril; entire; covering less than 1/2 of seed; cream.

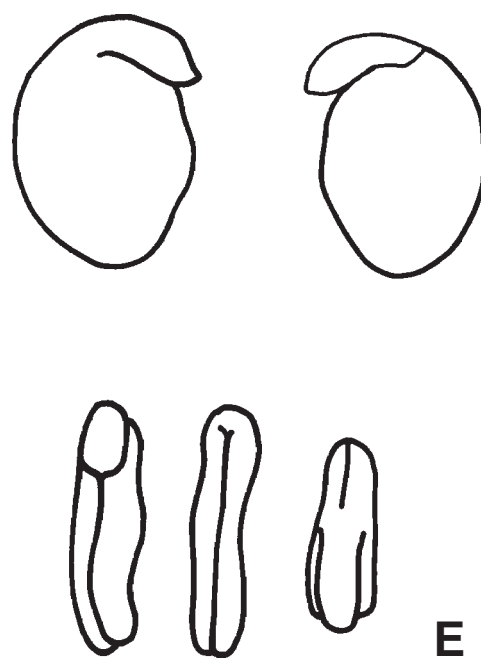
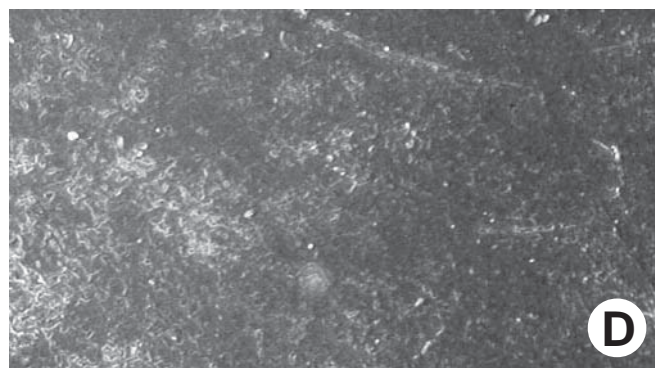
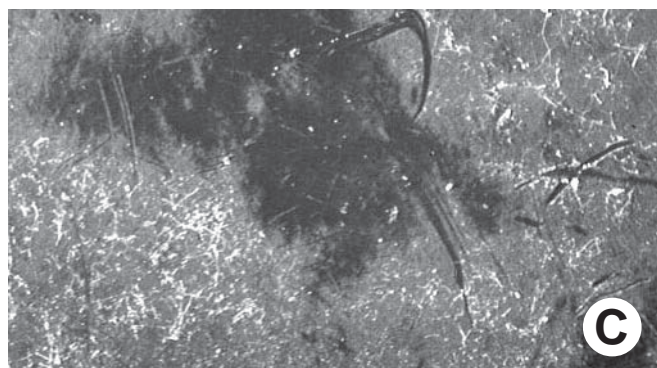
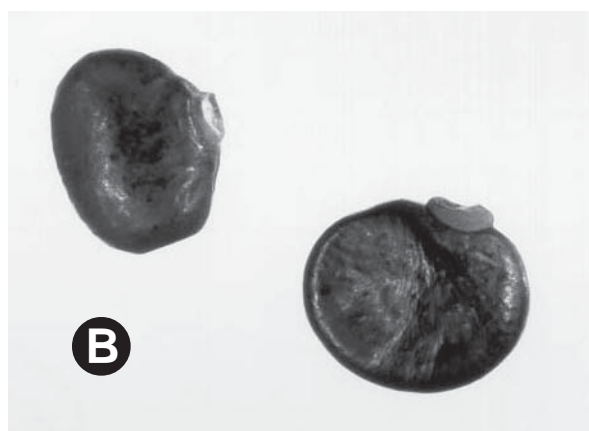
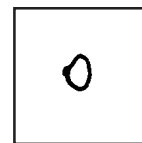
Seed $6.2 \times 5 \times 2.5$ mm; not overgrown; not angular; asymmetrical; elliptic; compressed; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; dull; not modified by a bloom; colored; mottled; with infrequent mottles; dark brown; with brown (lighter) overlay; glabrous; smooth; chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum partially concealed; concealed by aril; with faboid split; with the lips of the faboid split the same color as the rest of the hilum;

larger than punctiform; 1.5 mm long; with curved outline; elliptic; apical according to radicle tip but marginal according to seed length; recessed; within rim. Hilum rim color of testa. Lens discernible; equal to or greater than 0.5 mm in length; 1 mm long; with margins straight; linear; not in groove of raphe; confluent with hilum; flush; same color as testa; not within corona, halo, or rim. Endosperm absent. Cotyledons not smooth; sulcate; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing radicle; split over radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; yellow; inner face flat; glabrous around base of radicle. Embryonic axis oblique; perpendicular to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; linear; lobe tip curved; deflexed and parallel to cotyledon width; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Indochina.

Notes: Fruits studied were immature and from the same specimen.

Diphyllarium: *D. mekongense* F. Gagnepain (A–E). A, Fruits ($\times 1.4$); B, seeds ($\times 7.5$); C–D, testa ($\times 50$, $\times 1000$); E, embryos ($\times 8$).



Genus: *Mastersia* G. Bentham

Phylogenetic Number: 10.38.

Tribe: Phaseoleae.

Subtribe: Glycininae.

Species Studied—Species in Genus: 2 spp.—2 spp.

Fruit a legume; unilocular; $8-14 \times 2.4-3 \times 0.3-0.4$ cm; with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; asymmetrical; falcate or linear; when asymmetrical with both sutures parallelly curved or nearly straight; not inflated; flattened; with beak (short); declined; with solid beak the same color and texture as fruit; rounded at apex; apex aligned with longitudinal axis of fruit; rounded to tapered at base; base aligned to oblique (slightly) with longitudinal axis of fruit; with the apex and base uniform in texture; chartaceous or fragile, thinner than chartaceous like *Trifolium* (21.06); seed chambers externally visible. Fruit margin not constricted; without sulcus; embellished. Fruit wings 1 or 2; 1–2 mm wide; sutural; on 1 or both sutures. Fruit nonstipitate. Fruit indehiscent. Replum invisible. Epicarp glossy; monochrome; drying dark brown to black or black to yellow (reddish) to green (lighter in life); glabrous; eglandular; without spines; not smooth; with elevated features; not veined; not tuberculate; wrinkled; exfoliating in part or not exfoliating; with cracks; cracking transverse to fruit length. Mesocarp trace; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; chartaceous. Endocarp glossy; streaked; brown; with brown (various shades) overlay; smooth; subseptate; with septa thicker than paper, firm; with septa eglandular; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 5–20; length transverse to fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; 5 mm long; of 1 length only; filiform; contorted. Aril dry; rim- and tongue-aril; fimbriate; tan.

Seed $6.3 \times 3.4 \times 1.5$ mm; not overgrown; not angular; asymmetrical; reniform; compressed; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; dull; not modified by a bloom; colored; monochrome; dark reddish brown; glabrous; smooth; coriaceous. Fracture lines absent.

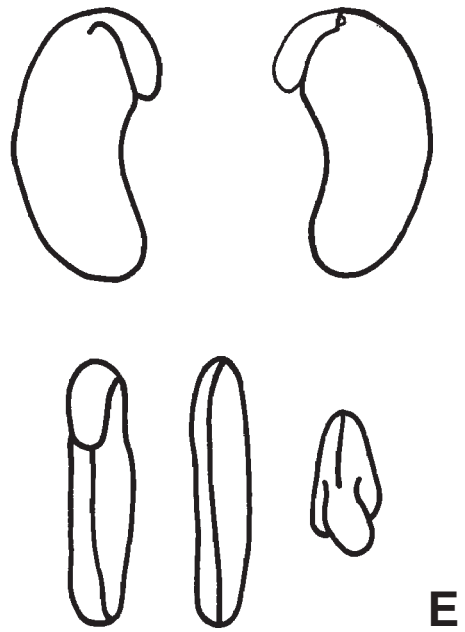
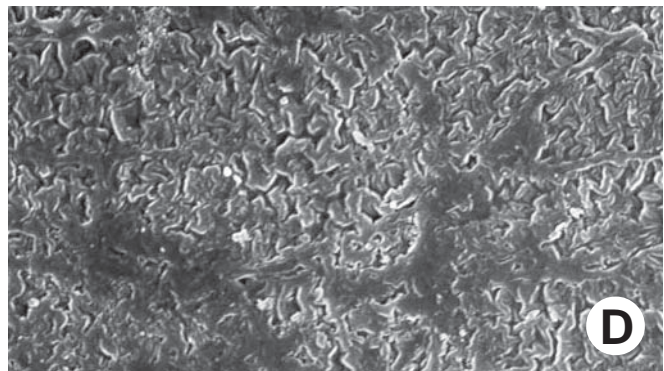
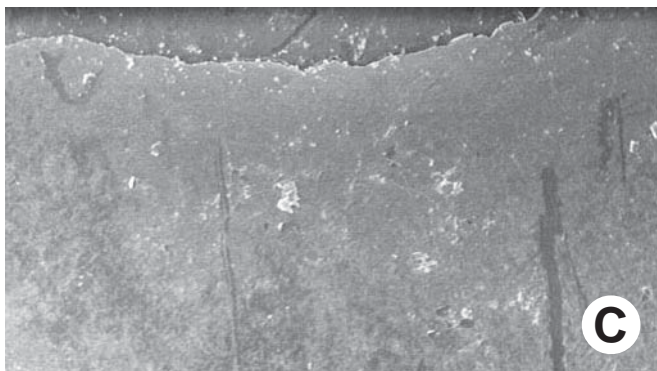
Rim absent. Wings absent. Raphe not visible. Hilum partially concealed; concealed by aril; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 1 mm long; with curved outline; circular; marginal according to radicle tip; recessed; not within corona, halo, or rim. Lens discernible; equal to or greater than 0.5 mm in length; 1 mm long; with margins straight; linear; not in groove of raphe; confluent with hilum; flush; similar color as testa; darker than testa; within halo. Lens halo color darker than testa. Endosperm absent. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing radicle; split over radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; brown; inner face flat. Embryonic axis straight; perpendicular to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; linear; lobe tip curved; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Indomalaysia.

Notes: Lackey (1981b) noted that *Mastersia* resembles *Shuteria* (10.41), “especially in its seeds.” Welzen and Hengst (1984) monographed *Mastersia*. Only one immature seed was studied internally.

Mastersia: *M. bakeri* (S.H. Koorders) C.A. Backer (C–E), *M. spp.* (A–B). A, Fruits ($\times 0.9$); B, seeds ($\times 7.7$); C–D, testa ($\times 50$, $\times 1000$); E, embryos ($\times 6$).

6



Genus: *Teyleria* C.A. Backer

Phylogenetic Number: 10.39.

Tribe: Phaseoleae.

Subtribe: Glycininae.

Species Studied—Species in Genus: 1 sp.—3 spp.

Fruit a legume; unilocular; $3-4 \times 0.4-0.5 \times 0.2-0.3$ cm; with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight to curved (slightly); not plicate; not twisted; asymmetrical or symmetrical; linear or falcate (slightly); when asymmetrical with both sutures parallelly curved; not inflated; compressed; with beak; straight; with solid beak the same color and texture as fruit; short tapered to rounded at apex; apex oblique with longitudinal axis of fruit; short tapered to rounded at base; base oblique with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous; seed chambers externally visible; with the raised seed chambers not torulose. Fruit margin not constricted; without sulcus; plain. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome; dark brown; pubescent and indurate; with hairs appressed; with 1 type of pubescence; with pubescence golden; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; not smooth; with elevated features; not veined; not tuberculate; dotted; not exfoliating; without cracks. Mesocarp trace; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; chartaceous. Endocarp dull; monochrome; tan; smooth; septate; with septa thin (tissue paper-like), flexible; with septa eglandular; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 6–8; length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus less than 0.5 mm long; of 1 length only; flattened; straight. Aril slightly fleshy; 2-lipped rim-aril; entire; covering less than 1/2 of seed; with tongues (or flap-like) on lips of 2-lipped rim-aril; with 1 tongue or flap on 1 lip of 2-lipped rim-aril; cream.

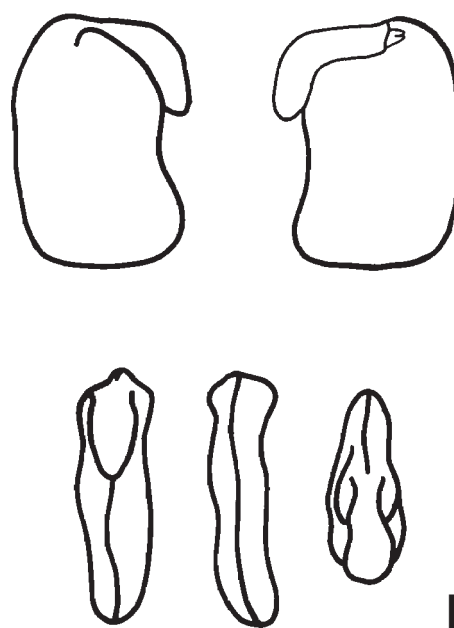
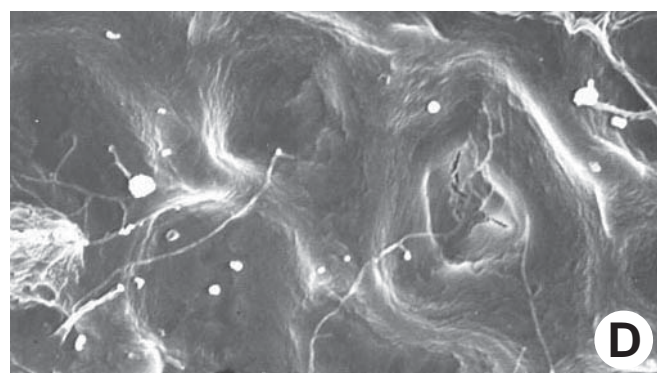
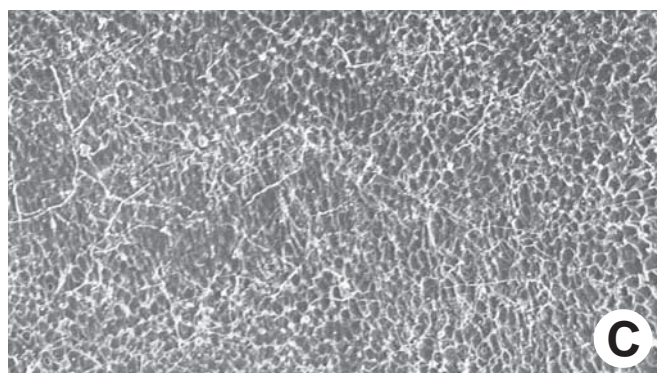
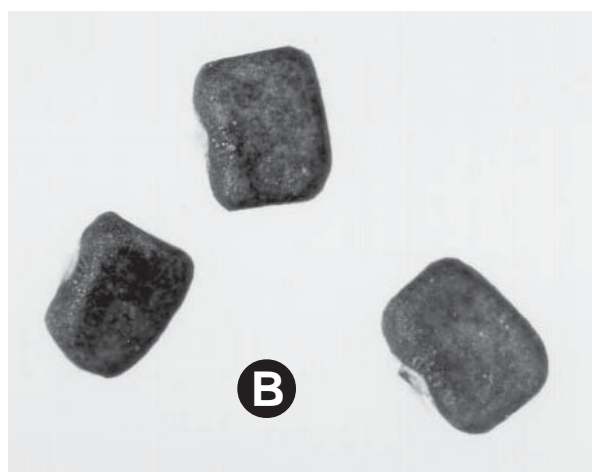
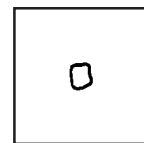
Seed $3-4.6 \times 2.8-3.7 \times 1.4-2$ mm; not overgrown; angular or not angular; symmetrical; oblong to rectangular; compressed; with surface smooth; without visible

radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering or partially adhering (few) to endocarp; dull; not modified or modified by a bloom; colored; monochrome or mottled; with frequent mottles; brown; with brown (dark) overlay; glabrous; not smooth; with elevated features; reticulate. Fracture lines present or absent; transverse. Rim absent. Wings absent. Raphe not visible. Hilum partially concealed; concealed by aril; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 0.8–1.1 mm long; with curved outline; elliptic; apical according to radicle tip but marginal according to seed length; recessed; within rim or corona. Hilum corona color darker than testa. Hilum rim color darker than testa. Lens discernible; less than 0.5 mm in length; with margins straight; linear; not in groove of raphe; confluent with hilum; flush; similar color as testa; darker than testa; brown; within rim or corona. Lens corona color darker than testa. Lens rim color darker than testa. Endosperm thick; covering entire embryo; adnate to embryo. Cotyledons not smooth; 1–3 grooves on each face; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing radicle; notched at radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; white; inner face flat; glabrous around base of radicle. Embryonic axis oblique; perpendicular to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; bulbous; lobe tip curved; with 90-degree turn or oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule moderately developed; glabrous.

Distribution: Asia.

Notes: Van der Maesen (1986) provided an abbreviated treatment of *Teyleria* in his monograph of *Pueraria* (10.26), and we are using his species count and not that of Lackey (1981b).

Teyleria: *T. koordersii* (C.A. Backer) C.A. Backer (A–E). A, Fruits ($\times 2.1$); B, seeds ($\times 7.9$); C–D, testa ($\times 50$, $\times 1000$); E, embryos ($\times 8$).



Genus: *Neonotonia* J.A. Lackey

Phylogenetic Number: 10.40.

Tribe: Phaseoleae.

Subtribe: Glycininae.

Species Studied—Species in Genus: 2 sp.—2 sp.

Fruit a legume; unilocular; $1.5\text{--}3.5 \times 0.2\text{--}0.6 \times 0.2\text{--}0.4$ cm; with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; asymmetrical or symmetrical; slightly moniliform to linear (nearly); when asymmetrical with both sutures parallelly curved or nearly straight; not inflated; compressed; without or with beak; straight; with solid beak (short) the same color and texture as fruit; apex aligned with longitudinal axis of fruit; tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; chartaceous to coriaceous (sub); seed chambers externally visible; with the raised seed chambers not torulose. Fruit margin slightly constricted to constricted along both margins; without sulcus; plain or embellished; with thickened sutural areas. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome; brown; pubescent and indurate; with 1 type of pubescence; sericeous to tomentose; with pubescence golden, tan, or brown; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; not smooth; with elevated features; not veined or veined; transversely veined relative to fruit length; not tuberculate; sparsely papillose; not exfoliating; without cracks. Mesocarp thin; 1-layered; without balsamic vesicles; without fibers; solid; chartaceous. Endocarp dull; monochrome; tan to white; smooth; septate; with septa thin (tissue paper-like), flexible; with septa eglandular; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 2–10; length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; 0.5–1 mm long; of 1 length only; flattened; triangular. Aril dry; rim- and tongue-aril; entire; white.

Seed $4.6\text{--}5.6 \times 2.5\text{--}4 \times 2.2\text{--}2.7$ mm; not overgrown; not angular; asymmetrical; reniform to rectangular (nearly); compressed; with surface smooth; without visible

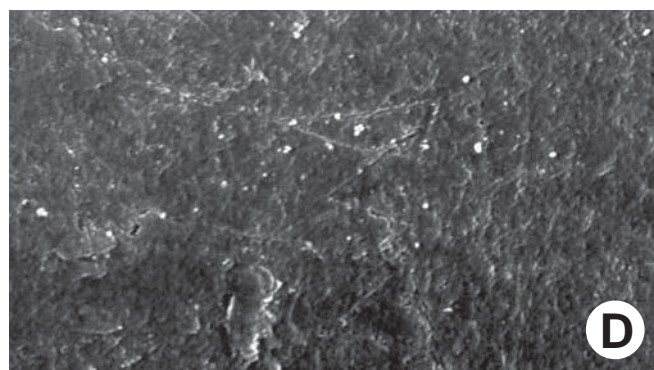
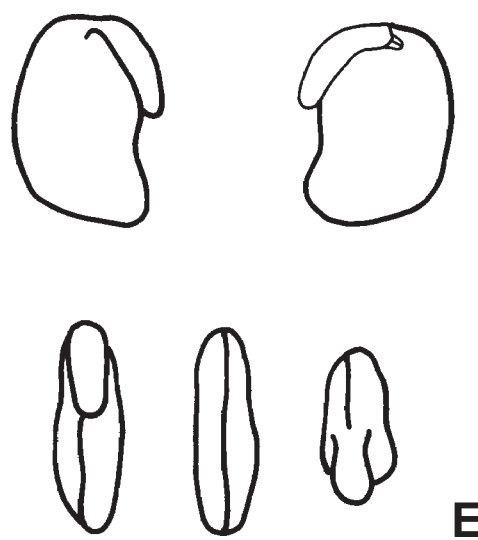
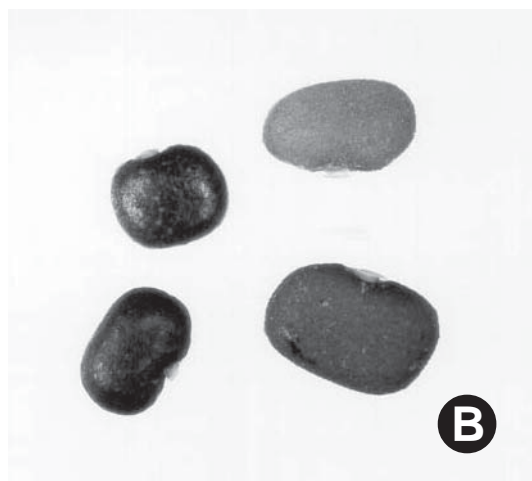
radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; glossy or dull; not modified by a bloom; colored; monochrome; brown; glabrous; not smooth or smooth; with elevated features; powdery and not rubbing off; chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum partially concealed; concealed by aril; without faboid split; larger than punctiform; 0.7–1 mm long; with curved outline; elliptic; marginal according to radicle tip; recessed; within halo. Hilum halo color darker than testa. Lens discernible; less than 0.5 mm or equal to or greater than 0.5 mm in length; up to 0.9 mm long; with margins straight; linear; not in groove of raphe; confluent with hilum; flush; similar color as testa; darker than testa; within halo. Lens halo color darker than testa. Endosperm thin; covering entire embryo, restricted to region of embryo, or covering at least 1/2 of embryo, but not entire embryo; adnate to testa. Cotyledons not smooth; sulcate; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing radicle; split over radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; yellow or tan; inner face flat; glabrous around base of radicle. Embryonic axis straight; perpendicular to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; linear; lobe tip curved; deflexed and parallel to cotyledon length; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Africa to Asia.

Notes: Isely (Isely et al. 1980) described the second species of this genus.

Neonotonia: *N. verdcourtii* D. Isely (C–E), *N. wightii* (G.A.W. Arnott) J.A. Lackey (A–B). A, Fruits ($\times 3$); B, seeds ($\times 7.9$); C–D, testa ($\times 50$, $\times 1000$); E, embryos ($\times 6$).

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Genus: *Shuteria* R. Wight & G.A.W. Arnott

Phylogenetic Number: 10.41.

Tribe: Phaseoleae.

Subtribe: Glycininae.

Species Studied—Species in Genus: 4 spp.—5 spp.

Fruit a legume; unilocular; $3-5 \times 0.4-0.5 \times 0.2-0.3$ cm; with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight or curved (slightly); not plicate; not twisted; symmetrical or asymmetrical; linear or falcate (slightly); when asymmetrical with both sutures parallelly curved; not inflated; compressed; with beak (very short); straight; with solid beak the same color and texture as fruit; short tapered at apex; apex oblique with longitudinal axis of fruit; short tapered to rounded at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; chartaceous; seed chambers externally visible (barely); with the raised seed chambers not torulose. Fruit margin not constricted; without sulcus; plain. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome or multicolored; mottled; orangish brown to dark brown; with brown overlay; pubescent and indurate; with 1 type of pubescence; pilose to puberulent; with pubescence golden; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; not smooth; with elevated features; veined or not veined; irregularly veined; not tuberculate; papillose; not exfoliating; with or without cracks; cracking oblique to fruit length. Mesocarp absent. Endocarp dull; monochrome; brown; smooth; nonseptate; chartaceous; not exfoliating; remaining fused to epicarp; entire. Seeds 4–11; length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus less than 0.5 mm long or measured; up to 0.6 mm long; of 1 length only; flattened; triangular. Aril dry; rim-aril or 2-lipped rim-aril; entire; with tongues (or flap-like) on lips of 2-lipped rim-aril; with 1 tongue or flap on 1 lip of 2-lipped rim-aril; cream.

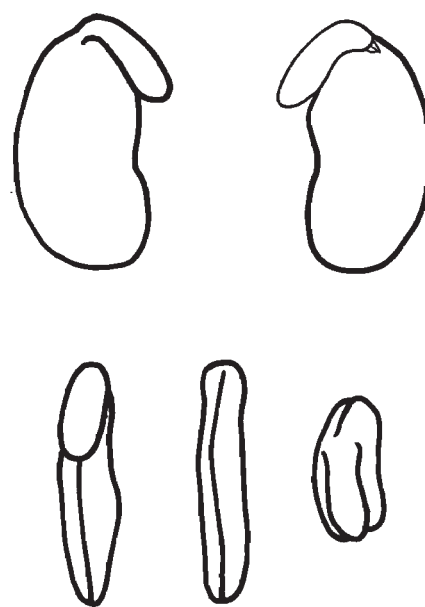
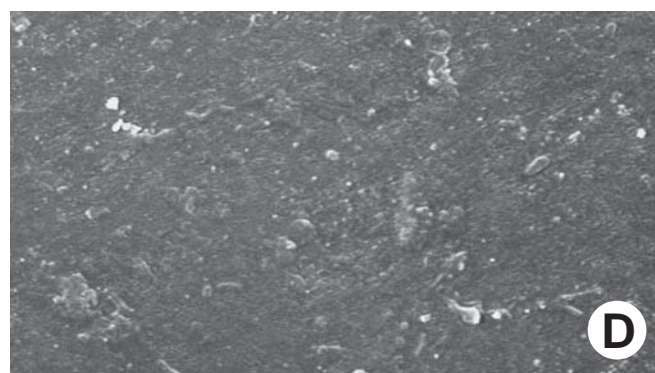
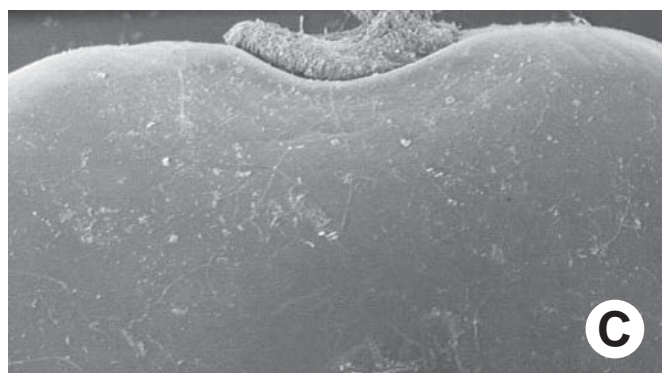
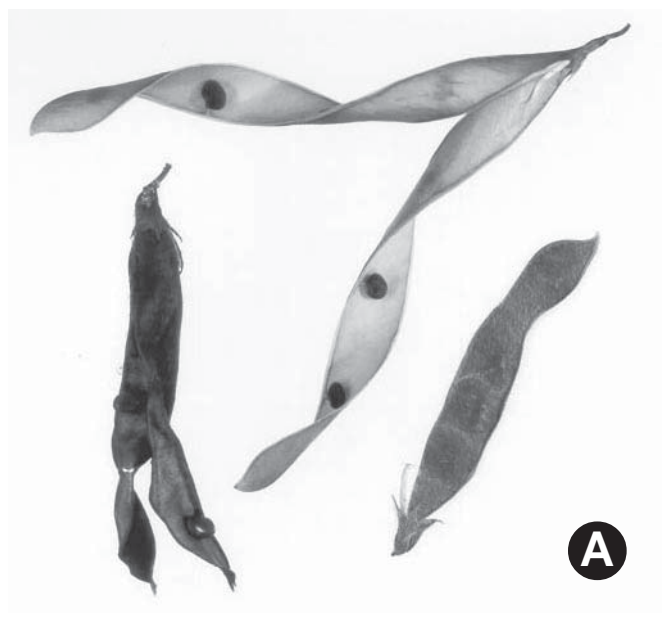
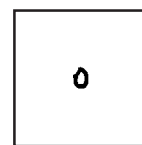
Seed $2.7-5 \times 1.7-3 \times 1.4-2.5$ mm; not overgrown; not angular; symmetrical or asymmetrical; reniform; terete to compressed; with surface smooth; with or without visible radicle and cotyledon lobes; without external

groove between radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; glossy to dull; not modified by a bloom; colored; monochrome or mottled; with frequent mottles; brown; with brown (darker) overlay; glabrous; not smooth; with recessed features; striate or pitted with small separate pits; coriaceous to chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum visible or partially concealed; concealed by aril; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 1–1.4 mm long; with curved outline; circular to elliptic; apical according to radicle tip but marginal according to seed length; recessed; within rim or corona. Hilum corona color darker than testa. Hilum rim color darker than testa. Lens discernible; less than 0.5 mm or equal to or greater than 0.5 mm in length; 0.5–0.7 mm long; with margins straight; linear; not in groove of raphe; confluent with hilum; recessed; similar color as testa; darker than testa; brown; within rim or corona. Lens corona color darker than testa. Lens rim color darker than testa. Endosperm thick; covering entire embryo; adnate to embryo. Cotyledons smooth or not smooth; 1–3 grooves on each face; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing or not concealing radicle; notched at radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; yellow; inner face flat; glabrous around base of radicle. Embryonic axis oblique; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; bulbous; lobe tip curved; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Indomalaysia.

Notes: Van Thuan (1972) revised this genus. Lackey (1981b) commented that *Shuteria* resembles *Mastersia* (10.38), “especially in its seeds.”

Shuteria: *S. involcrata* (N. Wallich) R. Wright & G.A.W. Arnott (*C–E*), *S. spp.* (*A–B*). *A*, Fruits ($\times 1.7$); *B*, seeds ($\times 7.6$); *C–D*, testa ($\times 50$, $\times 1000$); *E*, embryos ($\times 10$).



Genus: *Dumasia* A.-P. de Candolle

Phylogenetic Number: 10.42.

Tribe: Phaseoleae.

Subtribe: Glycininae.

Species Studied—Species in Genus: 4 spp.—8 spp.

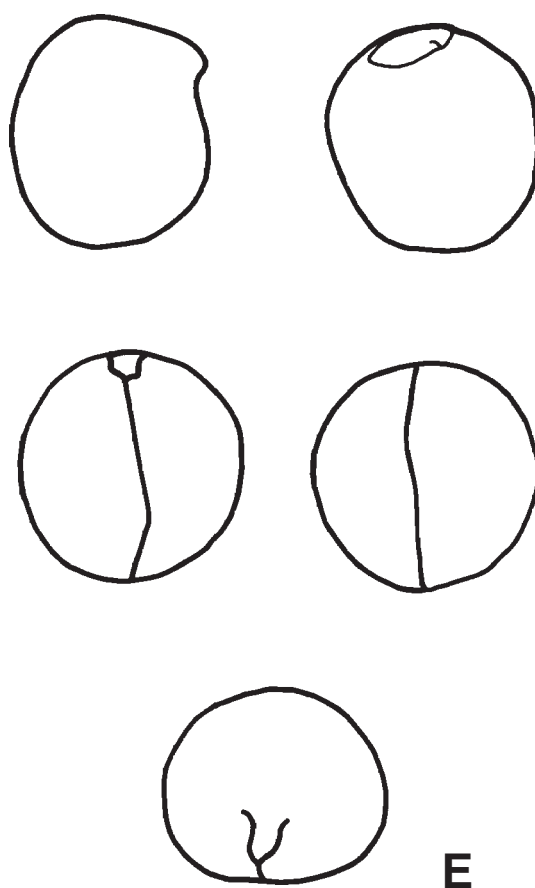
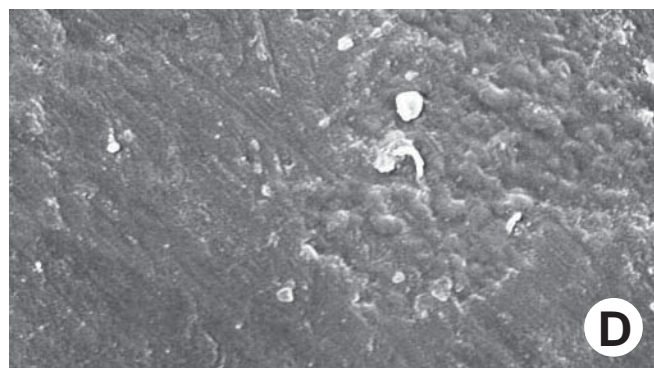
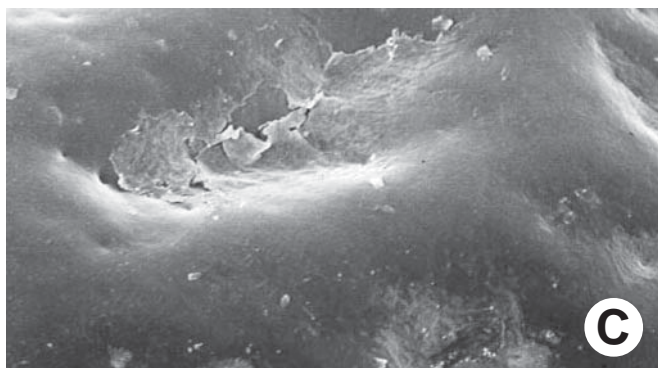
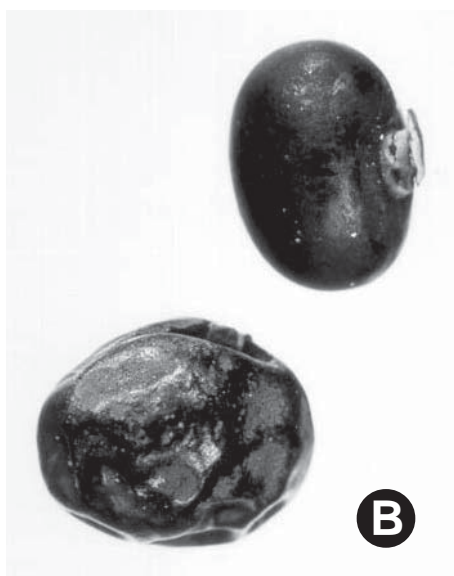
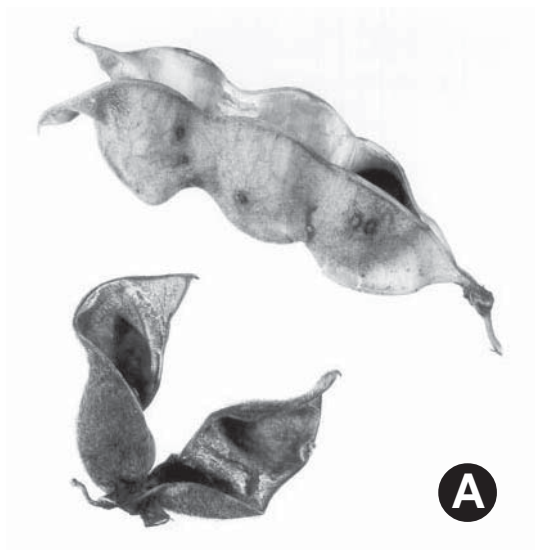
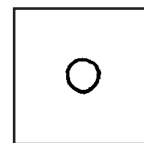
Fruit a legume; unilocular; $1.3\text{--}2.9 \times 0.7\text{--}0.8 \times 0.4\text{--}0.5$ cm; with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; asymmetrical or symmetrical; moniliform; when asymmetrical with both sutures parallelly curved; not inflated; compressed to terete; with beak (short); declined; with solid beak the same color and texture as fruit; short tapered at apex; apex aligned with longitudinal axis of fruit; tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; chartaceous; seed chambers externally visible; with the raised seed chambers not torulose. Fruit margin constricted along both margins; without sulcus; plain or embellished; with thickened sutural areas. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscent; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves reflexing. Replum invisible. Epicarp dull; monochrome; dark brown to tan; pubescent and indurate or pubescent but soon deciduous; with 1 type of pubescence; pilose or sericeous; with pubescence golden; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; smooth or not smooth; irregularly veined; not tuberculate; not exfoliating; without cracks. Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; solid; chartaceous. Endocarp dull; monochrome; tan; smooth; nonseptate; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 1–3; length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; $0.5\text{--}0.7$ mm long; of 1 length only; flattened; triangular. Aril dry; rim- and tongue-aril or rim-aril; entire; brown.

Seed $6.5\text{--}7.5 \times 5\text{--}6.3 \times 4.5\text{--}6$ mm; not overgrown; not angular; symmetrical; elliptic or ovate; terete; with surface smooth; without visible radicle and cotyledon lobes; with shallow hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; glaucous; modified by a bloom; colored; monochrome; black to brown (dark); glabrous; smooth; coriaceous. Fracture

lines absent. Rim absent. Wings absent. Raphe visible or not visible; from hilum to near base of seed and terminating; not bifurcating; color of testa; black or brown; recessed. Hilum partially concealed; concealed by aril; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; $1\text{--}2.2$ mm long; with curved outline; elliptic; marginal according to radicle tip; recessed; within rim. Hilum rim color of or darker than testa. Lens discernible; equal to or greater than 0.5 mm in length; $0.5\text{--}1$ mm long; with margins straight; linear; not in groove of raphe; confluent with hilum; flush; same color as testa; black or brown; within corona or not within corona, halo, or rim. Lens corona color darker than testa. Endosperm thin or trace; covering entire embryo or restricted to region of embryo; adnate to testa or embryo. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing radicle; split over radicle; without lobes; with the interface division terminating at base of radicle; with 1 margin recessed; recessed on same side as radicle; white or tan; inner face concave; glabrous around base of radicle. Embryonic axis right angled; perpendicular to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; triangular; lobe tip curved; oblique to cotyledons; centered between cotyledons; less than $1/2$ length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Africa and Asia.

Dumasia: *D. truncata* P.F.B. von Siebold & J.G. Zuccarini (C–E), *D. villosa* A.-P. de Candolle (A), *D. spp.* (B). A, Fruits ($\times 2.5$); B, seeds ($\times 7.1$); C–D, testa ($\times 50$, $\times 1000$); E, embryos ($\times 5$).



Genus: *Cologania* K.S. Kunth

Phylogenetic Number: 10.43.

Tribe: Phaseoleae.

Subtribe: Glycininae.

Species Studied—Species in Genus: 10 spp.—10 spp.

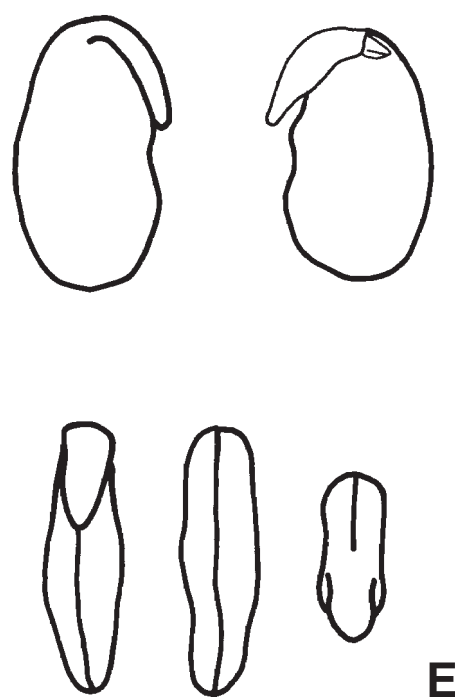
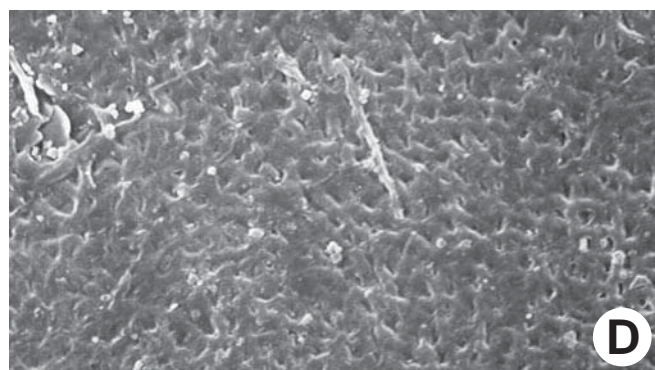
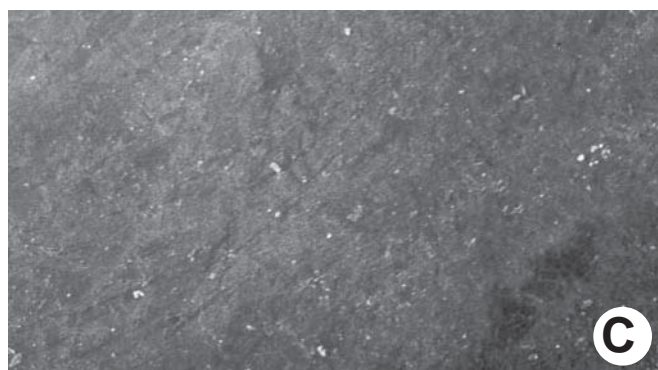
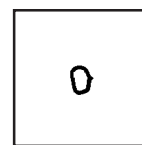
Fruit a legume; unilocular; $2-6 \times 0.3-0.6 \times 0.2-0.4$ cm; without orifice formed by curving of fruit or fruit segments; straight to curved; not plicate; not twisted; asymmetrical or symmetrical; linear or falcate; when asymmetrical with both sutures parallelly curved; not inflated; flattened to terete; with beak (short); declined; with solid beak the same color and texture as fruit; short tapered at apex; apex aligned with longitudinal axis of fruit; tapered or long tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous to chartaceous; seed chambers externally invisible or visible (slightly); with the raised seed chambers not torulose. Fruit margin not constricted; without sulcus; embellished; with thickened sutural areas. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome; tan to brown (dark); pubescent and indurate; with hairs erect or appressed; with 1 type of pubescence; puberulent or tomentose; with pubescence golden or gray; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; smooth; not veined; not tuberculate; without cracks. Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; solid; chartaceous. Endocarp dull; monochrome; tan to white; scurfy, smooth, or cracked; septate or subseptate; with septa thin (tissue paper-like), flexible; with septa eglandular; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 3–14; length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus less than 0.5 mm long; of 1 length only; flattened; triangular. Aril dry; rim- and tongue-aril; entire; brown to cream.

Seed $2.7-5.2 \times 2-3.5 \times 1.7-3$ mm; not overgrown; angular or not angular; symmetrical or asymmetrical; oblong, ovate, rectangular, reniform, or trapezoid; terete; with surface smooth; with or without visible radicle and cotyledon lobes; without external groove between

radicle and cotyledon lobes; with shallow or without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; dull; not modified by a bloom; colored; monochrome or mottled; with frequent mottles; brown, tan, or yellow; with black overlay; glabrous; smooth; chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum partially or fully concealed; concealed by aril; with or without faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 0.5–1 mm long; with curved outline; circular, elliptic, or oval; apical according to radicle tip but marginal according to seed length; flush; within corona. Hilum corona color lighter or darker than testa. Lens discernible; less than 0.5 mm in length; with margins straight or curved; linear or elliptic; not in groove of raphe; confluent with hilum; flush; same or similar color as testa; darker than testa; brown; within corona. Lens corona color darker than testa. Endosperm thick to thin; covering entire embryo; adnate to embryo. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; not concealing radicle; entire over radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; white, yellow, or tan; inner face flat; glabrous around base of radicle. Embryonic axis oblique to right angled; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; bulbous; lobe tip curved; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule moderately developed; glabrous.

Distribution: Mexico, Central and South America.

Cologania: *C. ovalifolia* K.S. Kunth (C–E), *C. spp.* (A–B). A, Fruits ($\times 2.4$); B, seeds ($\times 7.3$); C–D, testa ($\times 50$, $\times 1000$); E, embryos ($\times 8$).



Genus: *Amphicarpaea* S. Elliott ex T. Nuttall

Phylogenetic Number: 10.44.

Tribe: Phaseoleae.

Subtribe: Glycininae.

Species Studied—Species in Genus: 3 spp.—3 spp.

Fruit a legume; unilocular; $1.5\text{--}3.8 \times 0.5\text{--}1.1 \times 0.2\text{--}0.8$ cm; with persistent or deciduous calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; slightly curved or straight; not plicate; not twisted; asymmetrical or symmetrical; oblong or falcate; when asymmetrical with 1 straight and 1 curved suture or both sutures parallelly curved; widest near middle or D-shaped; not inflated; compressed; with or without beak; straight; with solid beak the same color and texture as fruit; tapered or rounded at apex; apex aligned with longitudinal axis of fruit; tapered or rounded at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; chartaceous to coriaceous; seed chambers externally visible to invisible; with the raised seed chambers not torulose. Fruit margin not constricted; without sulcus; plain or embellished; with ridges. Fruit wings absent. Fruit substipitate; with the stipe 2–4 mm long. Fruit with all layers dehiscent (aboveground fruits) or indehiscent (belowground fruits); splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome or multicolored; mottled; tan or brown; with brown overlay; with mottling over seed chambers; glabrous or pubescent and indurate; with 1 type of pubescence; puberulent [along sutural ridges (aboveground fruits) or all over (belowground fruits)]; with pubescence golden; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; smooth; reticulately veined; not tuberculate; not exfoliating; without cracks. Mesocarp present (aboveground fruits) or absent (belowground fruits); thin; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; chartaceous. Endocarp present (aboveground fruits) or absent (belowground fruits); dull; monochrome; tan; smooth or cobwebby; nonseptate; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp or to epicarp; entire. Seeds 1–3; length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; 0.5–0.8 mm long; of 1 length only; flattened;

triangular. Aril present or absent; dry; 2-lipped rim-aril; entire; with tongues (or flap-like) on lips of 2-lipped rim-aril; with 1 tongue or flap on 1 lip of 2-lipped rim-aril or 2 tongues or flaps, 1 on each lip of 2-lipped rim-aril; cream.

Seed $4\text{--}16 \times 4\text{--}11.3 \times 1.5\text{--}7.4$ mm; not overgrown or overgrown, 1 seed filling entire fruit cavity; not angular; symmetrical; reniform or ovate; compressed; with surface smooth or ridged; without or with visible radicle and cotyledon lobes; without external groove between radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; dull; not modified by a bloom; colored; mottled; brown (or reddish brown); with brown (dark) overlay; glabrous; smooth or not smooth; with elevated features; wrinkled; coriaceous or chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum partially concealed; concealed by aril; with or without faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 0.5–2 mm long; with curved outline; elliptic; apical according to radicle tip but marginal according to seed length; recessed; within rim. Hilum rim color of or darker than testa. Lens discernible; equal to or greater than 0.5 mm in length; 0.5–1.5 mm long; with margins straight; linear; not in groove of raphe; confluent with hilum; flush; similar color as testa; darker than testa; brown; not within corona, halo, or rim or within rim. Lens rim color darker than testa. Endosperm absent or present; trace; restricted to region of embryo; adnate to testa. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; not sufficiently folded for inner face to touch itself; margin entire 180 degrees from base of radicle; similar at apex; partially concealing radicle; notched at radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; tan or white; inner face flat; glabrous around base of radicle. Embryonic axis oblique; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; narrowly triangular; lobe tip curved; oblique to cotyledons; centered between cotyledons; less than $1/2$ length of cotyledons. Plumule moderately developed; glabrous.

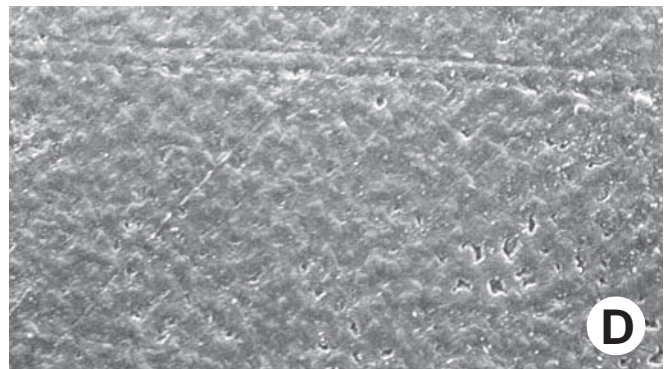
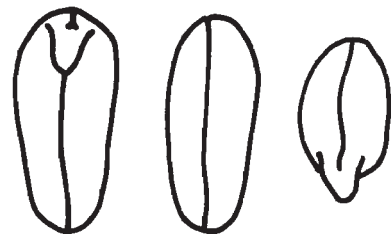
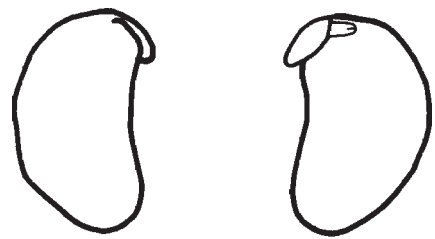
Distribution: North America, Africa, and Asia.

Notes: Turner and Fearing (1964) monographed *Amphicarpaea*. *Amphicarpaea bracteata* has heteromorphic seeds with large, underground, single-seeded

fruits and aerial, 1-3-seeded fruits. The spelling of this genus, *Amphicarpaea*, has been conserved against '*Amphicarpa*' (Greuter et al. 1994).

Amphicarpaea: *A. bracteata* (C. Linnaeus) M.L. Fernald
(*C-E*), *A. spp.* (*A-B*). *A*, Fruits ($\times 2.6$); *B*, seeds
($\times 3.8$); *C-D*, testa ($\times 50$, $\times 1000$); *E*, embryos ($\times 6$).

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Genus: *Calopogonium* A.N. Desvaux

Phylogenetic Number: 10.45.

Tribe: Phaseoleae.

Subtribe: Diocleinae.

Species Studied—Species in Genus: 5 spp.—8 spp.

Fruit a legume; unilocular; $1.5\text{--}12 \times 0.3\text{--}1 \times 0.2\text{--}0.5$ cm; with deciduous calyx; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; symmetrical; linear; not inflated; compressed; without beak; tapered or short tapered at apex; apex aligned with longitudinal axis of fruit; tapered or truncate at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; chartaceous or coriaceous; seed chambers externally visible; with the raised seed chambers not torulose. Fruit margin not constricted; plain or embellished; with thickened sutural areas. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves revolute. Replum invisible. Epicarp dull; monochrome or multicolored; mottled; brown; with brown (darker) overlay; pubescent and indurate or pubescent but soon deciduous; with 1 type of pubescence; puberulent, velutinous, or sericeous; with pubescence golden; with pubescence uniformly distributed or denser near sutures, sparse centrally; with simple hairs; pliable; with hair bases swollen or plain; eglandular; smooth or not smooth; with elevated features; not veined; not tuberculate; dotted; not exfoliating; without cracks. Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; solid; coriaceous or chartaceous. Endocarp dull; monochrome or mottled; tan; with mottling over seed chambers; with green overlay; smooth and floury-filamentous; septate to subseptate; with septa thin (tissue paper-like), flexible to thicker than paper, firm; with septa eglandular; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 3–11; length parallel with or oblique to fruit length; neither overlapping nor touching; in 1 series. Funiculus less than 0.5 mm long; of 1 length only; flattened; straight. Aril dry; rim-, tongue-, or partial rim-aril; entire or fimbriate; covering less than 1/2 of seed; cream to tan.

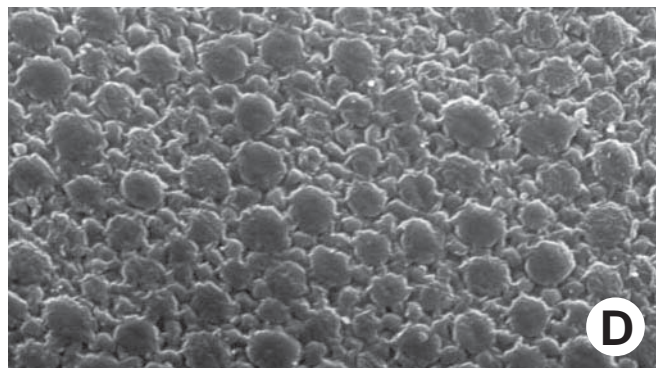
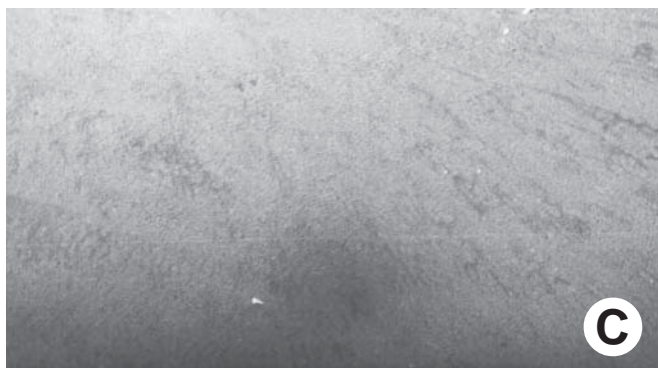
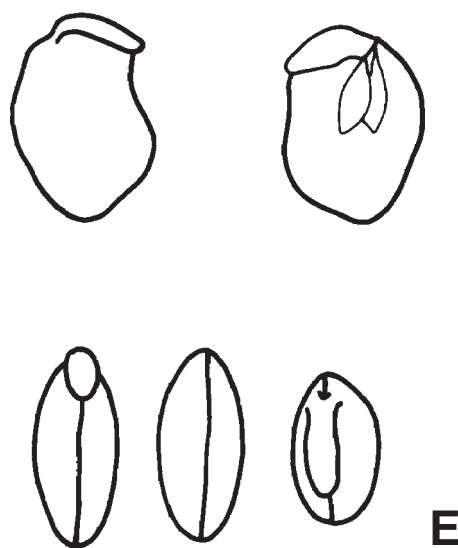
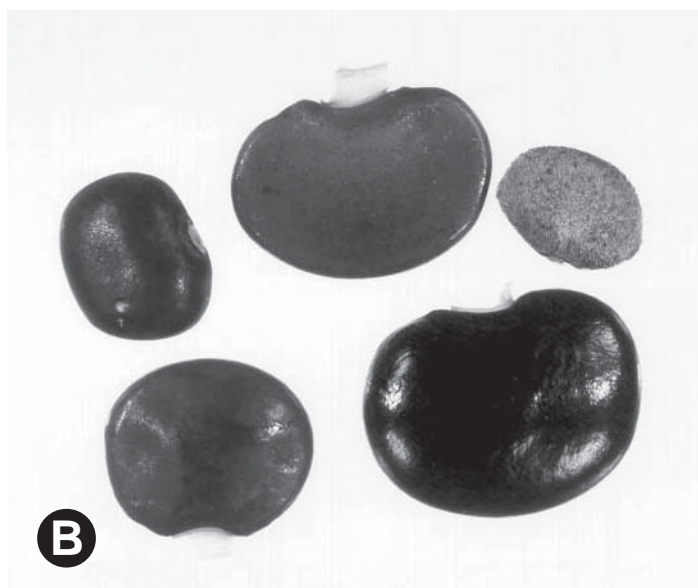
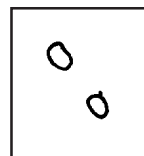
Seed $4.2\text{--}8 \times 2.6\text{--}5 \times 2\text{--}3$ mm; not overgrown; angular or not angular; symmetrical; ovate, rectangular, or

reniform; compressed; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; glossy or dull; not modified by a bloom; colored; monochrome or mottled; with frequent mottles; brown, tan, or yellow; with brown overlay; glabrous; smooth; coriaceous or chartaceous. Fracture lines absent or present (rarely); transverse. Rim absent. Raphe not visible. Hilum visible; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 1–2 mm long; with curved outline; elliptic; marginal according to radicle tip; recessed; within rim and halo, within rim, or within halo. Hilum halo color darker than testa. Hilum rim color of or darker than testa. Lens discernible; less than 0.5 mm to equal to or greater than 0.5 mm in length; 0.4–0.6 mm long; with margins straight; linear; not in groove of raphe; confluent with hilum; mounded or flush; same color as or dissimilar color from testa; darker than testa; black or brown; within rim or halo. Lens halo color darker than testa. Lens rim color of or darker than testa. Endosperm thin; covering entire embryo or restricted to region of embryo; adnate to testa or embryo. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; not concealing radicle; notched at radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; tan or green (rarely); inner face flat; glabrous around base of radicle. Embryonic axis right angled; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; bulbous or linear; lobe tip curved; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule well developed; glabrous.

Distribution: New World tropics; cultivated as a cover crop (*C. mucunoides* A.N. Desvaux).

Notes: *Calopogonium* was revised for Brazil by Carvalho-Okano and Leitão filho (1985).

Calopogonium: *C. galactoides* (K.S. Kunth) W.B. Hemsley (C–E), *C. spp.* (A–B). A, Fruits ($\times 1.5$); B, seeds ($\times 6.7$); C–D, testa ($\times 50$, $\times 1000$); E, embryos ($\times 6$).



Genus: *Pachyrhizus* A. Richard ex A.-P. de Candolle

Phylogenetic Number: 10.46.

Tribe: Phaseoleae.

Subtribe: Diocleinae.

Species Studied—Species in Genus: 4 spp.—5 spp.

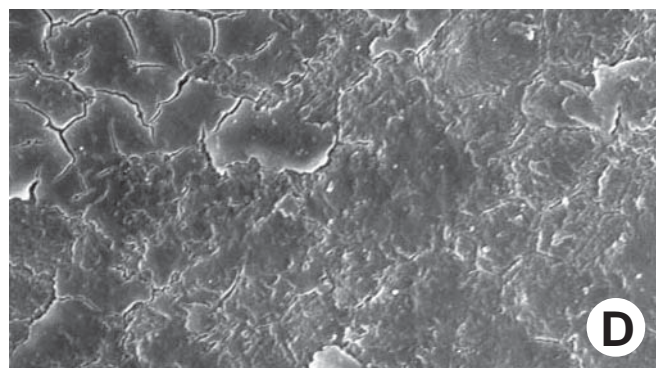
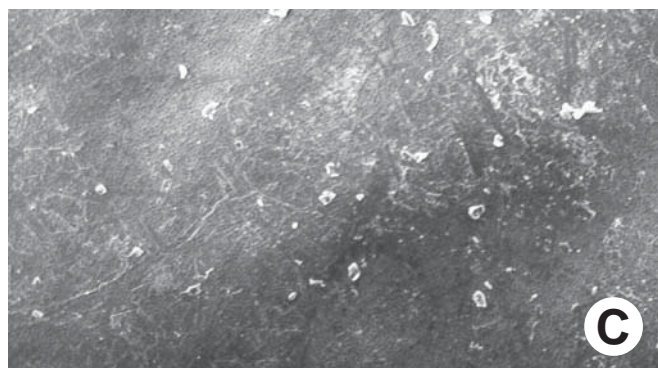
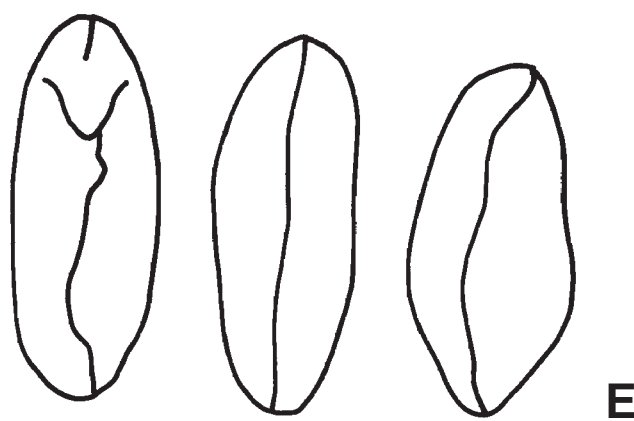
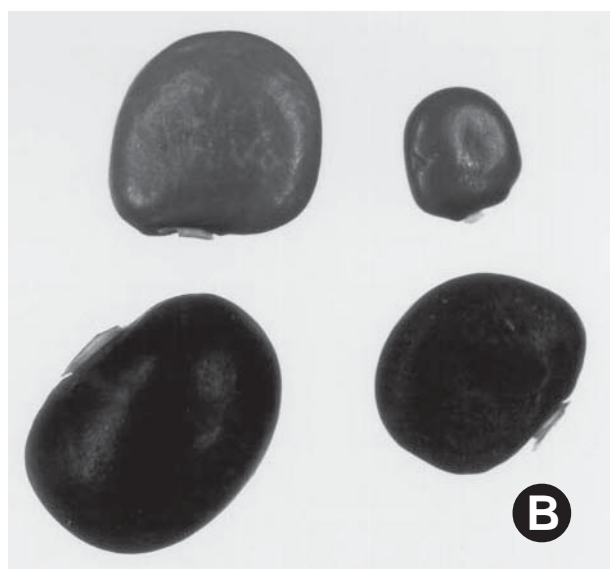
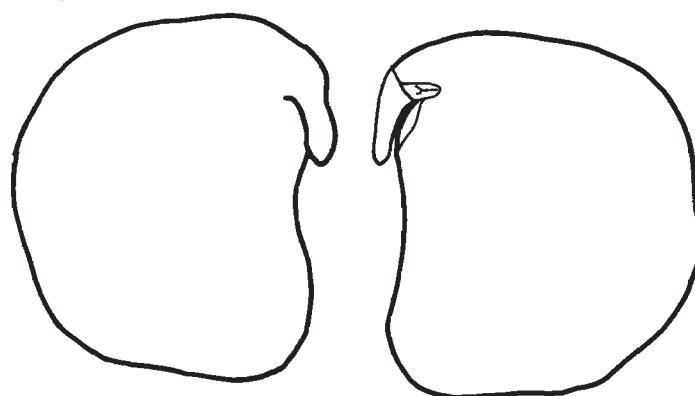
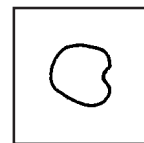
Fruit a legume; unilocular; $6\text{--}25.5 \times 0.8\text{--}2.8 \times 0.3\text{--}0.6$ cm; with persistent or deciduous calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; slightly curved; not plicate; not twisted; asymmetrical or symmetrical; linear; when asymmetrical with both sutures parallelly curved; not inflated; compressed to terete; without beak; tapered at apex; apex aligned or oblique with longitudinal axis of fruit; long tapered or tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous; seed chambers externally visible; with the raised seed chambers not torulose. Fruit margin not constricted; without sulcus; plain or embellished; with flanges (narrow) or thickened sutural areas. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome or multicolored; mottled; brown; with black, brown, or gray overlay; pubescent and indurate or pubescent but soon deciduous; with hairs erect or appressed; with 1 type of pubescence; tomentose or sericeous (and appressed); with pubescence golden; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; smooth or not smooth; with recessed features; not veined; not tuberculate; grooved; not exfoliating; with or without cracks; cracking oblique to fruit length. Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; solid; coriaceous. Endocarp dull; monochrome; tan; smooth and scurfy; septate; with septa thicker than paper, firm; with septa eglandular; chartaceous; exfoliating in part; remaining fused to mesocarp and epicarp; entire. Seeds 4–12(–18); length transverse to or parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; 1–2 mm long; of 1 length only; flattened; triangular. Aril dry; tongue-aril or 2-lipped rim-aril; entire; covering less than 1/2 of seed; cream.

Seed $9.5\text{--}15.5 \times 9\text{--}14.5 \times 4.5\text{--}6.5$ mm; not overgrown; angular or not angular; symmetrical or asymmetrical; D-shaped, quadrangular, rectangular, or reniform; compressed; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; dull; not modified by a bloom; colored; monochrome; brown to reddish brown, green (olive), red (brownish), or black; glabrous; smooth or not smooth; with recessed features; pitted with small separate pits; coriaceous. Fracture lines absent or present; transverse. Rim absent. Wings absent. Raphe not visible. Hilum partially concealed; concealed by aril; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 3.5–4 mm long; with curved outline; elliptic; apical at apex of radicle tip; recessed; within rim. Hilum rim color of testa. Lens discernible; equal to or greater than 0.5 mm in length; 2.3–2.5 mm long; with margins straight; linear; not in groove of raphe; confluent with hilum; recessed; dissimilar color from testa; black; within rim. Lens rim color of or darker than testa. Endosperm absent. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing radicle; notched at radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; white to tan; inner face flat; glabrous around base of radicle. Embryonic axis straight or oblique; parallel to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; bulbous; lobe tip straight or curved (slightly); straight with embryonic axis; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary to moderately developed; glabrous.

Distribution: Neotropics and widely cultivated.

Notes: Sørensen (1988) monographed the genus, and our species count is based on his treatment rather than that of Lackey (1981b).

Pachyrhizus: *P. erosus* (C. Linnaeus) I. Urban (C–E), *P.* spp. (A–B). A, Fruits ($\times 1$); B, seeds ($\times 3.2$); C–D, testa ($\times 50$, $\times 1000$); E, embryos ($\times 5$).



Genus: *Kennedia* E.P. Ventenat

Phylogenetic Number: 10.47.

Tribe: Phaseoleae.

Subtribe: Kennediinae.

Species Studied—Species in Genus: 10 spp.—15 spp.

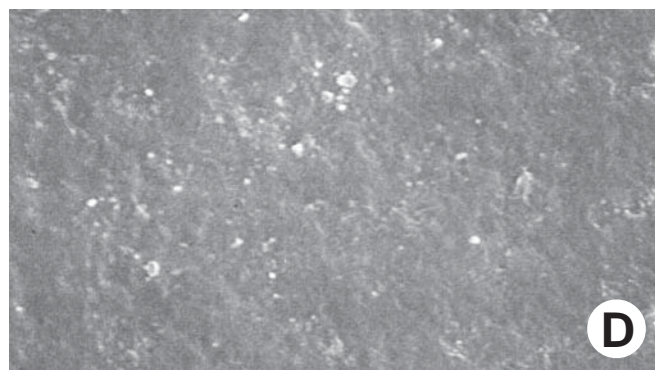
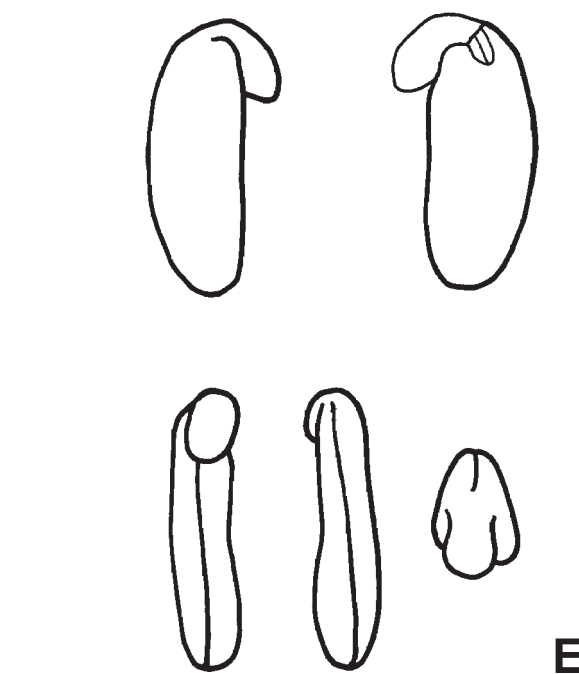
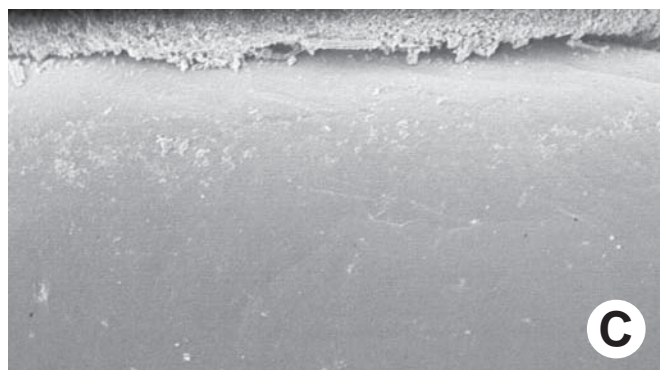
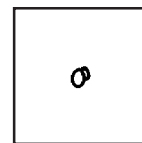
Fruit a legume; unilocular; $3-7 \times 0.7-1.2 \times 0.3-0.7$ cm; with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; symmetrical (or nearly symmetrical); linear; not inflated; compressed; without beak; tapered at apex; apex aligned to oblique with longitudinal axis of fruit; short tapered to tapered at base; base aligned to oblique with longitudinal axis of fruit; with the apex and base uniform in texture; chartaceous to coriaceous; seed chambers externally visible or invisible. Fruit margin not constricted or constricted (rarely slightly); slightly constricted along both margins; without sulcus; plain or embellished; with thickened sutural areas. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome; light to dark brown; pubescent and indurate, glabrous, or pubescent but soon deciduous; with 1 type of pubescence; tomentose or sericeous; with pubescence gray-brown or gray; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; smooth or not smooth; with elevated features; not veined; not tuberculate; drying wrinkled; not exfoliating; without cracks. Mesocarp thin; 2-layered; without balsamic vesicles; without fibers; with spongy layer over solid layer; coriaceous. Endocarp dull; monochrome or mottled; brown or tan; with mottling and mottling (dark) over seed chambers; with brown overlay; smooth; septate; with septa thin (tissue paper-like), flexible; chartaceous; exfoliating in part; remaining fused to mesocarp and epicarp; entire. Seeds 4–9; length transverse or oblique to fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; up to 2.5 mm long; of 1 length only; flattened; triangular. Aril fleshy; annular (bulbous and partially extended over lens at end opposite radicle lobe, narrow at end near radicle lobe); entire to crenate; covering less than 1/2 of seed; with tongues (or flap-like) on lips of 2-lipped rim-aril; with 1 tongue or flap on 1 lip of 2-lipped rim-aril; tan.

Seed $3.7-8.5 \times 3.8-5$ (including aril) $\times 2.8-2.9$ mm; not overgrown; not angular; asymmetrical; reniform; terete; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; dull; not modified by a bloom; colored; monochrome or mottled; with frequent mottles; brown (or dark brown); with brown (darker) overlay; glabrous; smooth; coriaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum partially concealed; concealed by aril; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 2.4 mm long; with curved outline; elliptic; marginal according to radicle tip; flush; within halo. Hilum halo color darker than testa. Lens discernible (but mostly hidden by aril); equal to or greater than 0.5 mm in length; up to 1.5 mm long; with margins straight; linear; not in groove of raphe; confluent with hilum; flush; similar color as testa; darker than testa; within halo. Lens halo color darker than testa. Endosperm thick; covering entire embryo; adnate to embryo. Cotyledons not smooth; sulcate; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; not concealing radicle; entire over radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; tan; inner face flat; glabrous around base of radicle. Embryonic axis oblique; oblique or parallel to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; bulbous; lobe tip curved; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule well developed; glabrous.

Distribution: Australia.

Notes: Berg (1979) studied the myrmecochorous dispersal of *Kennedia* and *Hardenbergia* (10.48) seeds.

Kennedia: *K. macrophylla* (C.F.W. Meissner) G. Benth (C–E), *K. spp.* (A–B). A, Fruits ($\times 1.4$); B, seeds ($\times 5$); C–D, testa ($\times 50$, $\times 1000$); E, embryos ($\times 8$).



Genus: *Hardenbergia* G. Benth

Phylogenetic Number: 10.48.

Tribe: Phaseoleae.

Subtribe: Kennediinae.

Species Studied—Species in Genus: 2 spp.—2 spp.

Fruit a legume; unilocular; 3.5–4.5 (from literature) \times 0.3–1.1 (from literature) \times 0.4 cm (from literature); with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; slightly curved; not plicate; not twisted; asymmetrical; nearly linear; when asymmetrical with both sutures parallelly curved; not inflated; compressed to terete; without beak; short tapered at apex; apex aligned (nearly) with longitudinal axis of fruit; tapered to short tapered at base; base oblique with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous; seed chambers externally invisible. Fruit margin not constricted; without sulcus; embellished; with thickened sutural areas. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscent; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome; brown (to violet brown in literature); glabrous; eglandular; without spines; not smooth; with elevated or recessed features; not veined; not tuberculate; minutely, obliquely rugose; slitted obliquely; not exfoliating; without cracks. Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; coriaceous. Endocarp dull; monochrome; orangish brown or tan; smooth or cracked; nonseptate; chartaceous; exfoliating in part; remaining fused to mesocarp and epicarp; entire. Seeds 5–6; length transverse to fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; up to 2 mm long; of 1 length only; flattened; triangular. Aril fleshy; annular to 2-lipped rim-aril (with lips fused, but thinner in area of fusion); entire to crenate; covering less than 1/2 of seed; with tongues (or flap-like) on lips of 2-lipped rim-aril; with 1 tongue or flap on 1 lip of 2-lipped rim-aril or 2 tongues or flaps, 1 on each lip of 2-lipped rim-aril.

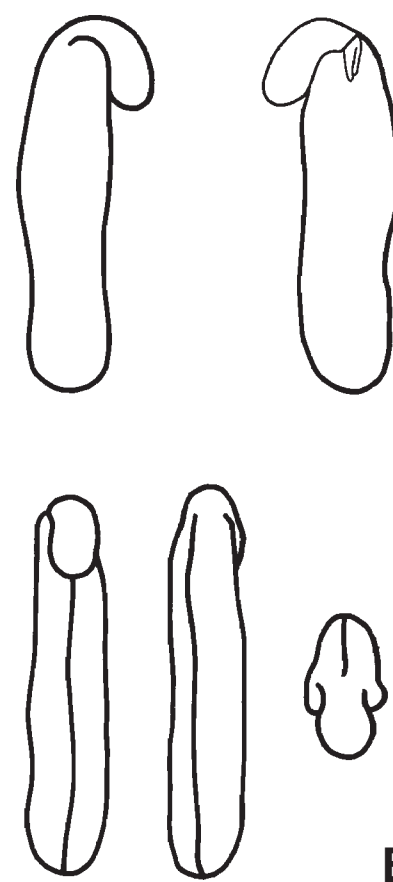
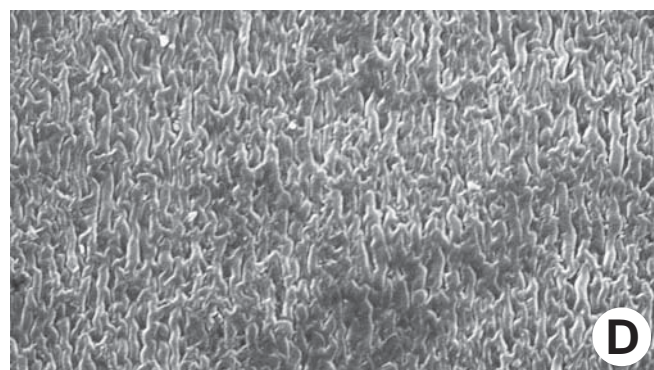
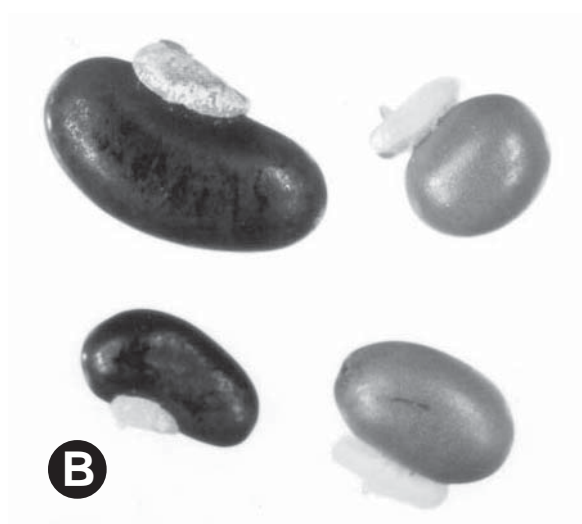
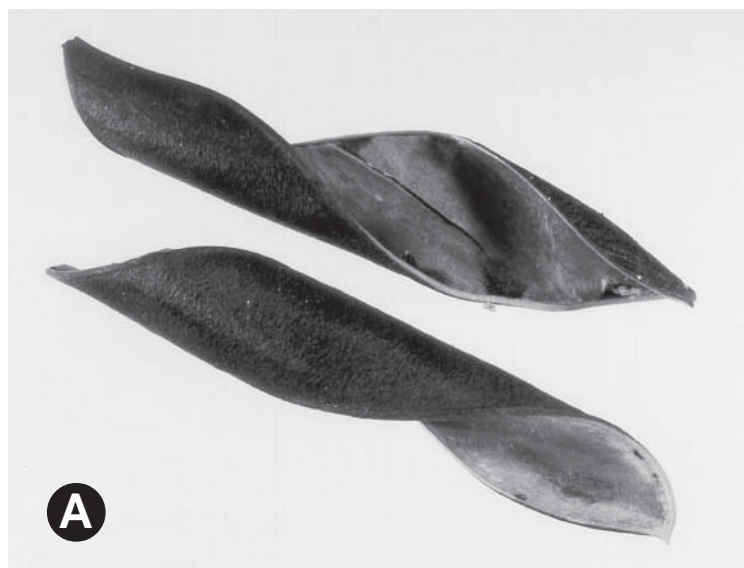
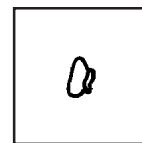
Seed 5.5–9 \times 2.6–4.5 \times 2.5–4 mm; not overgrown; not angular; asymmetrical; elliptic to rectangular; terete; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on

seed faces. Testa not adhering to endocarp; dull; not modified by a bloom; colored; monochrome; brown; glabrous; smooth; chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum partially concealed; concealed by aril; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 2.5–4 mm long; with curved outline; elliptic; marginal according to radicle tip; flush; not within corona, halo, or rim. Lens discernible; equal to or greater than 0.5 mm in length; up to 1.5 mm long; with margins straight; linear; not in groove of raphe; confluent with hilum; flush; similar color as testa; darker than testa; within halo. Lens halo color darker than testa. Endosperm thick; covering entire embryo; adnate to embryo. Cotyledons not smooth; sulcate; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; not concealing radicle; split over radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; tan; inner face flat; glabrous around base of radicle. Embryonic axis oblique; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; bulbous; lobe tip curved; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule well developed; glabrous.

Distribution: Australia.

Notes: Berg (1979) studied the myrmecochorous dispersal of *Hardenbergia* and *Kennedia* (10.47) seeds.

Hardenbergia: *H. violacea* (G.V. Schneevogt) W.T. Stearn (A, C–E), *H. spp.* (B). A, Fruits (\times 2.6); B, seeds (\times 6); C–D, testa (\times 50, \times 1000); E, embryos (\times 6).



Genus: *Vandasina* S. Rauschert

Phylogenetic Number: 10.49.

Tribe: Phaseoleae.

Subtribe: Kennediinae.

Species Studied—Species in Genus: 1 sp.—1 sp.

Fruit a legume; unilocular; $6-9.2 \times 1.5-2$ cm; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; asymmetrical; nearly linear; when asymmetrical with both sutures parallelly curved; not inflated; compressed; without to with beak (short); declined; with solid beak the same color and texture as fruit; tapered to short tapered at apex; apex oblique with longitudinal axis of fruit; tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous; seed chambers externally invisible. Fruit margin not constricted; without sulcus; plain or embellished; with thickened (slightly) sutural areas. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome; brown; pubescent but soon deciduous; with 1 type of pubescence; sericeous; with pubescence golden; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; not smooth; with recessed features; not veined; not tuberculate; slitted obliquely; not exfoliating; with cracks; cracking oblique to fruit length. Mesocarp thick; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; ligneous. Endocarp dull; mottled; tan; with mottling (dark); with brown overlay; spongy; nonseptate; chartaceous; exfoliating in part; remaining fused to mesocarp and epicarp; entire. Seeds 4; length transverse to fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; up to 3 mm long; of 1 length only; thick; straight. Aril fleshy; annular or 2-lipped rim-aril (with lips fused, but narrower at fusion point); crenate; covering less than $1/2$ of seed; with tongues (or flap-like) on lips of 2-lipped rim-aril; with 1 tongue or flap on 1 lip of 2-lipped rim-aril.

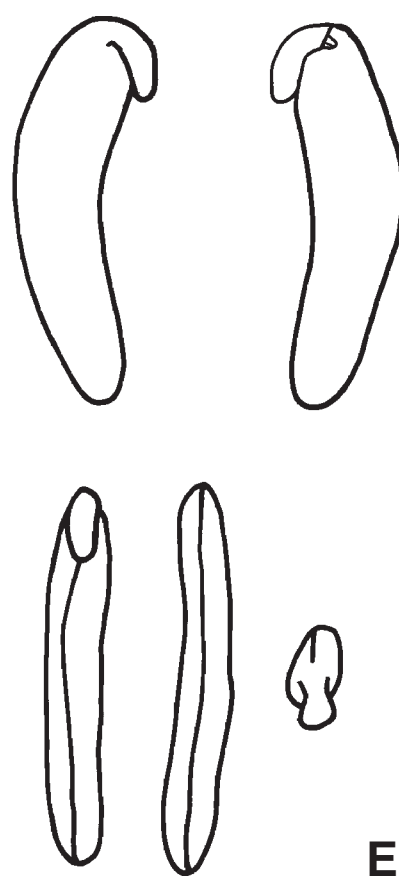
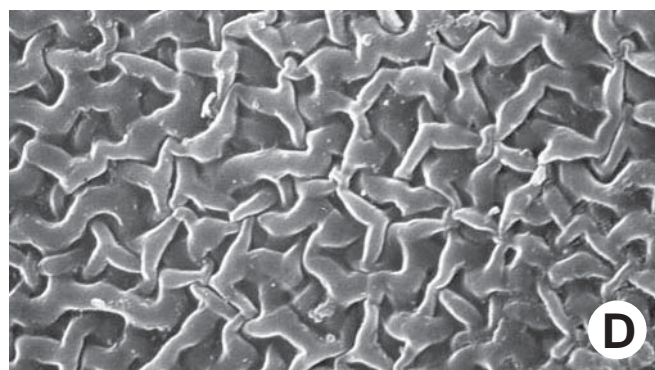
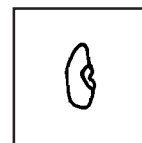
Seed $10-12 \times 4.2-5.7 \times 3.5-3.7$ mm; not overgrown; not angular; asymmetrical; reniform to elliptic; terete to compressed (slightly); with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus;

without umbo on seed faces. Testa not adhering to endocarp; dull; not modified by a bloom; colored; monochrome; brown; glabrous; smooth; coriaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum partially concealed; concealed by aril; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 4.2–5 mm long; with curved outline; elliptic; marginal according to radicle tip; recessed; not within corona, halo, or rim. Lens discernible; equal to or greater than 0.5 mm in length; up to 1.2 mm long; with margins straight; linear; not in groove of raphe; confluent with hilum; flush; similar color as testa; darker than testa; not within corona, halo, or rim or within halo. Lens halo color darker than testa. Endosperm thick; covering entire embryo; adnate to testa or embryo. Cotyledons not smooth; sulcate; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; not concealing radicle; entire over radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; tan; inner face flat; glabrous around base of radicle. Embryonic axis oblique; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; bulbous; lobe tip curved; oblique to cotyledons; centered between cotyledons; less than $1/2$ length of cotyledons. Plumule rudimentary; glabrous.

Distribution: New Guinea and Australia (Queensland).

Notes: The name *Vandasia* K. Domin, used by Lackey (1981b), was rejected because it is a later homonym of *Vandasia* J. Velenovsky (Gasteromycetes). Rauschert (1982) replaced it with *Vandasina*. Lackey noted that this genus is “a segregate of *Hardenbergia* (10.48) from which it differs by the larger keel.” Only two fruits were studied.

Vandasina: *V. retusa* (G. Benth) S. Rauschert (A–E). A, Fruits ($\times 1.2$); B, seeds ($\times 6.7$); C–D, testa ($\times 50$, $\times 1000$); E, embryos ($\times 5$).



Genus: *Dysolobium* (G. Benth) D. Prain

Phylogenetic Number: 10.50.

Tribe: Phaseoleae.

Subtribe: Phaseolinae.

Species Studied—Species in Genus: 2 spp.—4 spp.

Fruit a legume; unilocular; $3.5\text{--}20 \times 0.8\text{--}2.3$ cm; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; symmetrical; linear; not inflated; compressed to terete; without beak; tapered or short tapered at apex; apex aligned with longitudinal axis of fruit; short tapered or rounded at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous to ligneous; seed chambers externally invisible. Fruit margin not constricted; without sulcus; plain or embellished; with ridges or thickened sutural areas. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; pubescent and indurate; with hairs erect or appressed; with 1 type of pubescence; puberulent or velutinous; with pubescence golden; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; not smooth; with elevated features; not veined; not tuberculate; rugose and wrinkled; not exfoliating; without cracks. Mesocarp thick; surface not veined; 2-layered; without balsamic vesicles; without fibers; with solid layer over solid layer; ligneous to coriaceous. Endocarp dull; monochrome; brown to tan; smooth; septate; with septa thicker than paper, firm; with septa eglandular; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 3–15; length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; 1–3 mm long; of 1 length only; flattened; straight or triangular. Aril dry; rim-aril and tongue-aril; entire; cream to tan.

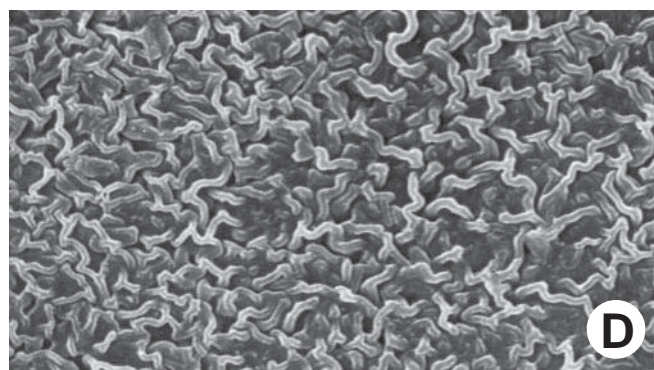
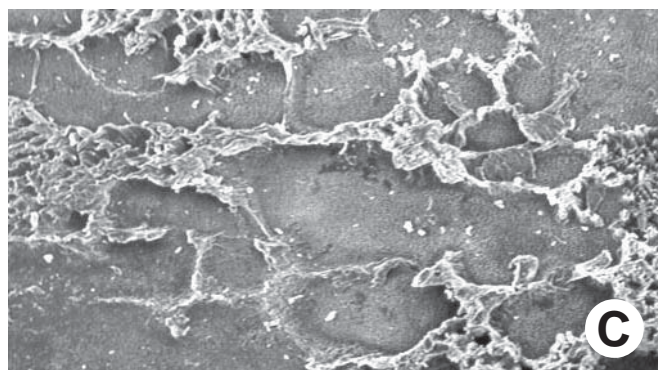
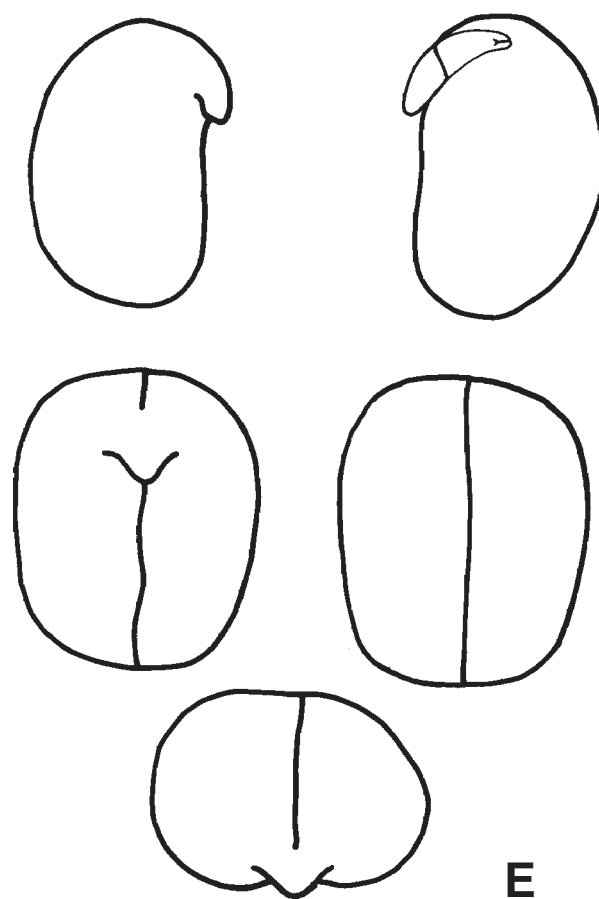
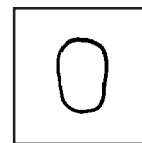
Seed $4.8\text{--}13.7 \times 4.7\text{--}10 \times 4.1\text{--}11$ mm; not overgrown; not angular; symmetrical; circular to oblong; terete; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; dull; not modified by a bloom; colored; monochrome; dark brown; glabrous; smooth or not smooth; with elevated features; reticulate; coriaceous. Fracture lines absent. Rim absent.

Wings absent. Raphe not visible. Hilum partially concealed; concealed by aril; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 1.7–6.1 mm long; with curved outline; elliptic or oval; apical according to radicle tip but marginal according to seed length; recessed; within rim or not within corona, halo, or rim. Hilum rim color of testa. Lens discernible; equal to or greater than 0.5 mm in length; 1.3–1.7 mm long; with margins straight or curved; linear; circular; not in groove of raphe; confluent with hilum; recessed; same color as testa; dark brown; within rim or not within corona, halo, or rim. Lens rim color of testa. Endosperm apparently absent. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing radicle; notched at radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; orange; inner face flat; glabrous around base of radicle. Embryonic axis oblique; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; bulbous; lobe tip curved; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule well developed; glabrous.

Distribution: Asia.

Notes: Lackey (1981b) noted “the genus resembles *Psophocarpus* [10.51] in many respects, but Maréchal et al. (1978) doubted a close natural relationship of the two genera.” Our seed and fruit data do not support Lackey’s conclusion, but rather that of Maréchal. Welzen and Hengst (1985) monographed *Dysolobium*. Only one fruit was studied; additional information was taken from Welzen and Hengst.

Dysolobium: *D. grande* (N. Wallich ex G. Benth) D. Prain (C–E), *D. spp.* (A–B). A, Fruits ($\times 0.5$); B, seeds ($\times 3.6$); C–D, testa ($\times 50$, $\times 1000$); E, embryos ($\times 3$).



Genus: *Psophocarpus* N.J. de Necker ex A.-P. de Candolle

Phylogenetic Number: 10.51.

Tribe: Phaseoleae.

Subtribe: Phaseolinae.

Species Studied—Species in Genus: 4 spp.—10 spp.

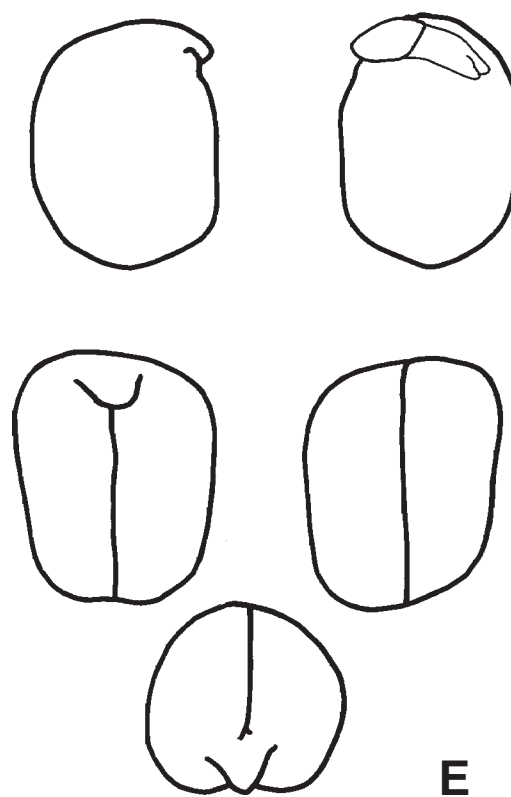
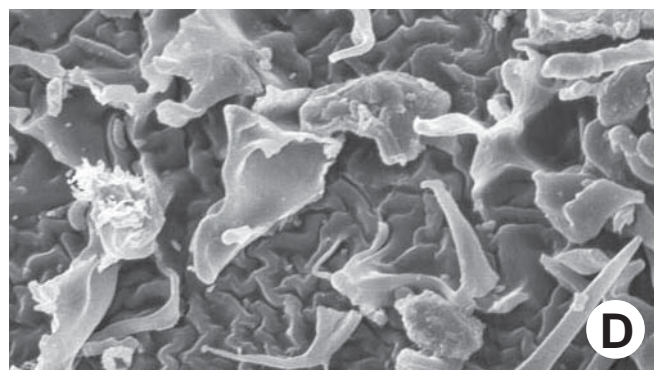
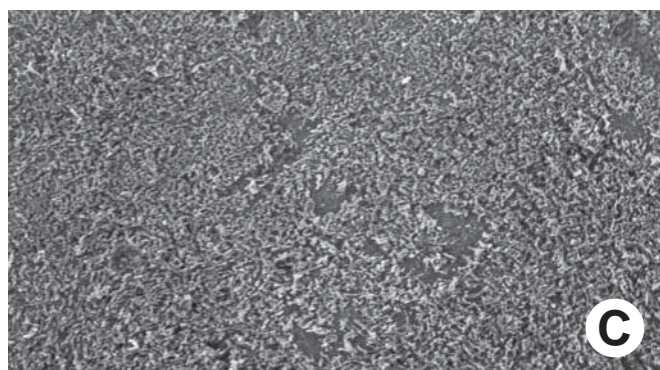
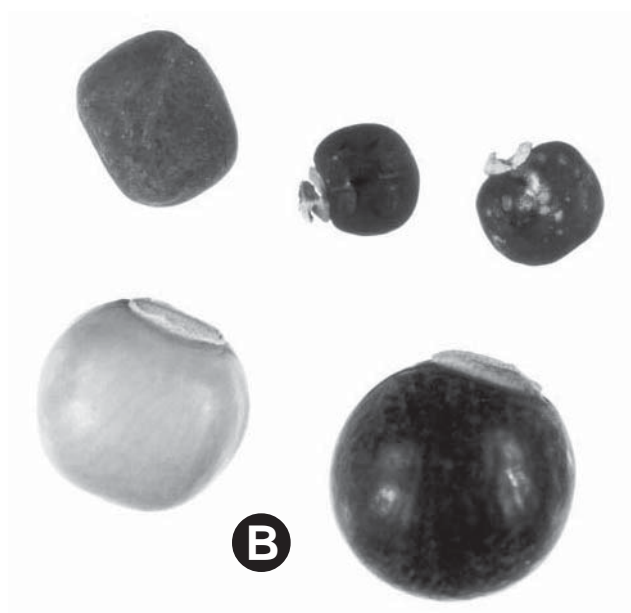
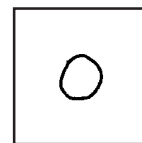
Fruit a legume; unilocular; 1.5–14(–40) (extreme limit from literature) \times 0.6–2(–3.5) \times 0.7–1.5 cm; with persistent or deciduous calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight or curved (slightly); not plicate; not twisted; asymmetrical or symmetrical; linear to oblong; not inflated; quadrangular; without beak; short tapered, rounded, or truncate at apex; apex aligned with longitudinal axis of fruit; rounded to truncate at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous to leathery; seed chambers externally invisible. Fruit margin not constricted; without sulcus; plain or embellished. Fruit wings 4; (1–)2–6(–10) mm wide; valvular; on both valves (2 on each valve). Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome; brown; glabrous or pubescent and indurate; puberulent; with simple hairs; eglandular; without spines; smooth or not smooth; with elevated features; not veined; not tuberculate; rarely warty; not exfoliating; with or without cracks; cracking oblique to fruit length. Mesocarp thick; surface not veined; 1- or 2-layered; without balsamic vesicles; without fibers; solid; with solid layer over solid layer; subligneous to coriaceous. Endocarp dull; monochrome or bichrome; tan and brown or white and brown; cobwebby, scurfy, and smooth; septate; with septa thin (tissue paper-like), flexible; with septa eglandular; chartaceous; exfoliating in part; remaining fused to mesocarp and epicarp; entire. Seeds 3–21; length parallel with or transverse to fruit length; neither overlapping nor touching; in 1 series. Funiculus less than 0.5 mm long; of 1 length only; thick; straight. Aril present or absent; dry; 2-lipped rim-aril; entire; covering less than 1/2 of seed; with tongues (or flap-like) on lips of 2-lipped rim-aril; with 1 tongue or flap on 1 lip of 2-lipped rim-aril; cream.

Seed 3–12.5 \times 3–12.2 \times 2.5–11 mm; not overgrown; angular or not angular; symmetrical; circular, elliptic,

irregular, oblong, or ovate; terete to quadrangular to compressed; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; glossy to dull; not modified by a bloom; colored; monochrome or mottled (from literature); black, brown, cream, white, or yellow; with brown overlay; glabrous or minutely pubescent; smooth or not smooth (rarely); with elevated features; with 1 longitudinal ridge on each face; coriaceous to chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe visible or not visible; from hilum through lens and base of seed to point opposite hilum; not bifurcating; color of testa; brown; recessed. Hilum partially concealed; concealed by aril; with faboid split; with the lips of the faboid split the same or lighter color than the rest of the hilum and therefore conspicuous; larger than punctiform; 2.2–5.5 mm long; with curved outline; elliptic; apical according to radicle tip but marginal according to seed length; flush; within rim or not within corona, halo, or rim. Hilum rim color of testa. Lens discernible; less than 0.5 mm or equal to or greater than 0.5 mm in length; 0.8–1.8 mm long; with margins straight or curved; linear, circular, or elliptic; not in groove or in groove of raphe; confluent with hilum; mounded or flush; same or similar color as testa; darker than testa; black or brown (dark); not within corona, halo, or rim. Endosperm absent. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing radicle; notched at radicle; without lobes; with the interface division terminating at base of radicle; without or with 1 margin recessed; recessed on same side as radicle; yellow; inner face flat; glabrous around base of radicle. Embryonic axis right angled or oblique; perpendicular to oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; bulbous or triangular; lobe tip straight; straight with embryonic axis or oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule moderately developed to well developed; glabrous.

Distribution: Paleotropics.

Psophocarpus: *P. palustris* A.N. Desvaux (C–E), *P.* spp. (A–B). A, Fruits (\times 1); B, seeds (\times 3.9); C–D, testa (\times 50, \times 1000); E, embryos (\times 5).



Genus: *Physostigma* J.H. Balfour

Phylogenetic Number: 10.52.

Tribe: Phaseoleae.

Subtribe: Phaseolinae.

Species Studied—Species in Genus: 4 spp.—4 spp.

Fruit a legume; unilocular; $5-17 \times 0.5-5$ cm; with persistent or deciduous calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight to curved (to slightly curved); not plicate; not twisted; asymmetrical or symmetrical; fusiform, linear, or falcate; when asymmetrical with both sutures parallelly curved; not inflated; compressed; without or with beak; straight, declined, or hooked; with solid beak the same color and texture as fruit; long tapered or tapered at apex; apex aligned or oblique with longitudinal axis of fruit; tapered to rounded at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous to ligneous; seed chambers externally invisible or visible; with the raised seed chambers not torulose. Fruit margin not constricted or constricted (slightly); constricted along both margins; without sulcus; plain or embellished; with thickened sutural areas. Fruit wings absent. Fruit stipitate or nonstipitate; with the stipe 5–15 mm long. Fruit with all layers dehiscent; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome; brown or green; glabrate or pubescent and indurate; with 1 type of pubescence; puberulent; with pubescence white; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases swollen; eglandular; without spines; smooth or not smooth; with elevated features; veined or not veined; transversely veined relative to fruit length; not tuberculate; dotted; not exfoliating; without cracks. Mesocarp thick or thin; surface uniformly veined; 2-layered; with balsamic vesicles; without fibers; with solid layer over solid layer; subligneous. Endocarp dull; monochrome; tan to white; cobwebby, scurfy, and smooth; nonseptate; chartaceous or osseous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 2–9; length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; 1–5 mm long (or longer); of 1 length only; flattened; triangular or convoluted. Aril dry; 2-lipped rim-aril (partial or whole); entire;

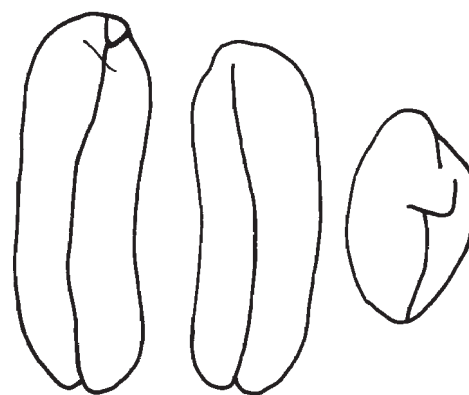
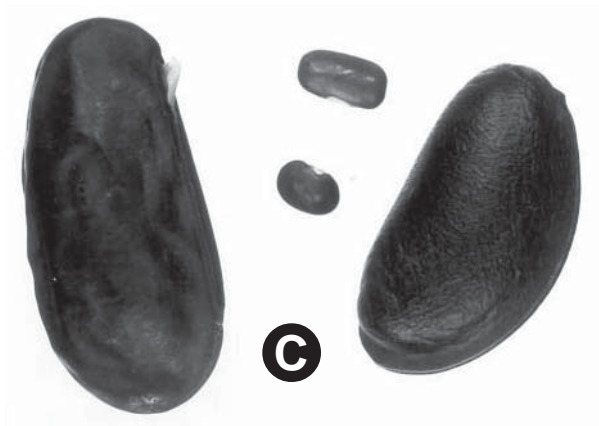
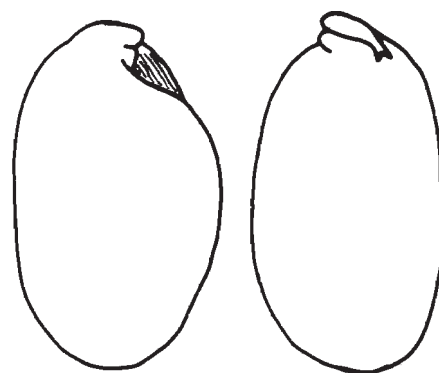
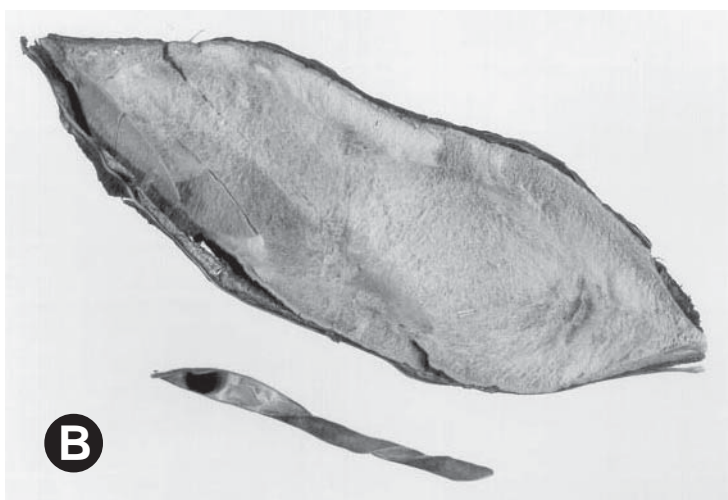
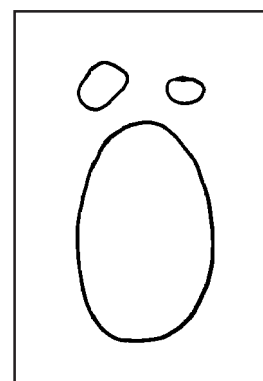
without tongue (or flap-like) on lips of 2-lipped rim-aril; cream.

Seed $5-48 \times 3.5-23 \times 2-18.5$ mm; not overgrown; not angular; asymmetrical; nearly elliptic, irregular, or ovate; compressed; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering or partially adhering to endocarp; glossy to dull; not modified by a bloom; colored; monochrome; dark brown or brown; glabrous; smooth or not smooth; with elevated features; reticulate to wrinkled; coriaceous. Fracture lines absent. Rim absent. Wings absent. Raphe visible or not visible; from lens to base of seed and terminating; not bifurcating; color of testa; brown; raised or recessed. Hilum visible or partially concealed; concealed by funicular remnant and aril, funicular remnant, or aril; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 1.4–41 mm long; with straight outline; linear; marginal according to radicle tip; flush or recessed; within rim or not within corona, halo, or rim. Hilum rim color of, lighter, or darker than testa. Lens discernible; equal to or greater than 0.5 mm in length; 0.9–9 mm long; with margins straight or curved; linear, triangular; or circular; not in groove or in groove of raphe; confluent with hilum; flush or recessed; same or similar color as testa; darker than testa; brown; within rim or not within corona, halo, or rim. Lens rim color of testa. Endosperm present or absent; thick; covering entire embryo; adnate to embryo. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; not concealing radicle; notched at radicle or split over radicle; without lobes; with the interface division terminating at base of radicle; with 1 margin recessed; recessed on same side as radicle; yellow; inner face concave or flat; glabrous around base of radicle. Embryonic axis right angled or oblique; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; bulbous or triangular; lobe tip straight; with 180-degree turn, straight with embryonic axis, or oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

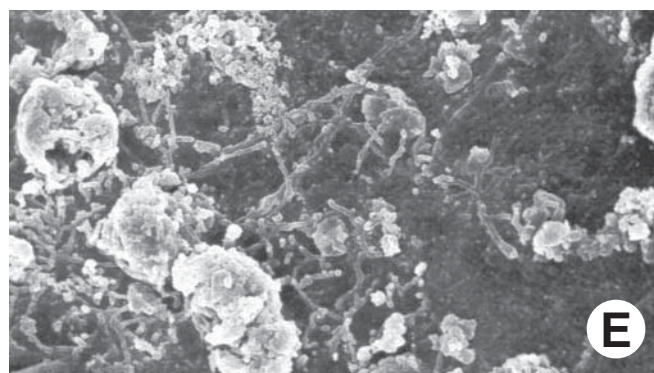
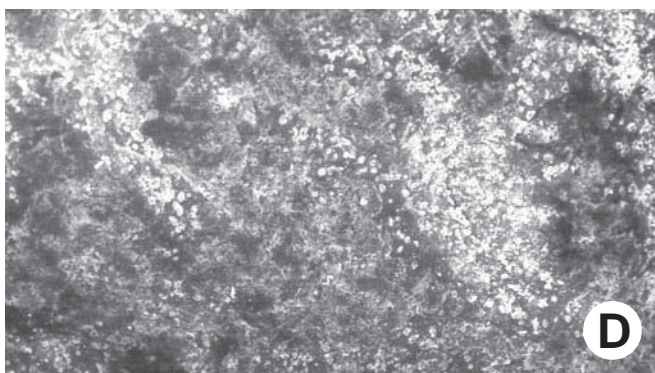
Distribution: Tropical Africa.

Notes: *Physostigma* has been divided into subgenera, in part using seed characteristics (Gillett 1966a, Maréchal et al. 1978): subgenus *Physostigma* with 2–3 ovules per locule and the seed ca. 3 cm long and subgenus *Taubertiophyton* with 7–12 ovules per locule and the seed ca. 0.5 cm long.

Physostigma: *P. venenosum* J.H. Balfour (*D–F*), *P. spp.* (*A–C*). *A–B*, Fruits ($\times 0.9$); *C*, seeds ($\times 1.3$); *D–E*, testa ($\times 50$, $\times 1000$); *F*, embryos ($\times 1.5$).



F



Genus: *Vatovaea* E. Chiovenda

Phylogenetic Number: 10.53.

Tribe: Phaseoleae.

Subtribe: Phaseolinae.

Species Studied—Species in Genus: 1 sp.—1 sp.

Fruit a legume; unilocular; $3.7\text{--}5 \times 0.8\text{--}1 \times 0.3\text{--}0.6$ cm; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; asymmetrical; falcate; when asymmetrical with both sutures parallelly curved; not inflated; flattened to compressed; with beak (short); straight; with solid beak the same color and texture as fruit; short tapered at apex; apex oblique with longitudinal axis of fruit; rounded at base; base oblique with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous; seed chambers externally visible (barely); with the raised seed chambers not torulose. Fruit margin not constricted; without sulcus; embellished; with thickened sutural areas. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; multicolored; mottled; tan to brown; with green overlay; pubescent and indurate; with hairs appressed; with 1 type of pubescence; with pubescence white; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; not smooth; with elevated features; not veined; not tuberculate; wrinkled; not exfoliating; without cracks. Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; solid; coriaceous to chartaceous. Endocarp dull; monochrome; yellowish green; smooth; nonseptate to septate; with septa thin (tissue paper-like), flexible; with septa eglandular; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp to separating from mesocarp; entire. Seeds 3–5; length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; 1–1.5 mm long; of 1 length only; flattened; triangular to anvil-shaped. Aril dry; rim-aril and tongue-aril; entire; ivory.

Seed $6\text{--}8 \times 5\text{--}7 \times 3.3\text{--}4.6$ mm; not overgrown; not angular; symmetrical; elliptic to oblong; compressed; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; dull; not

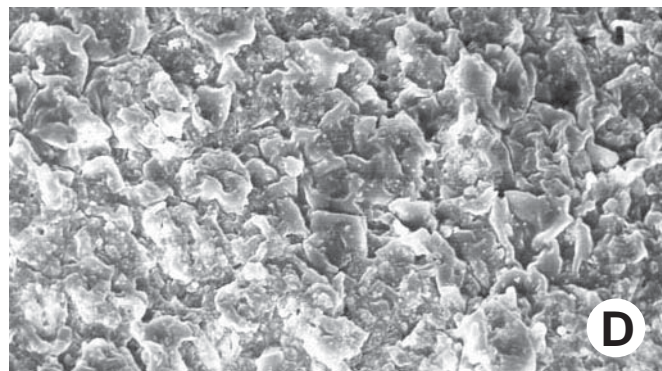
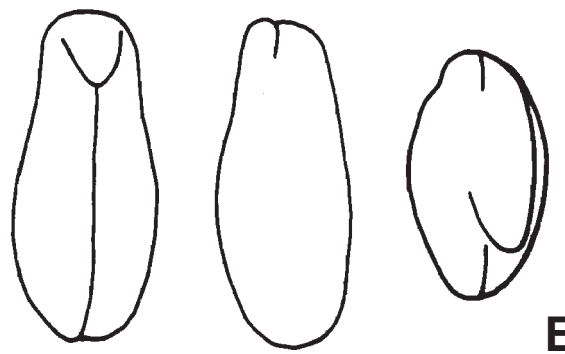
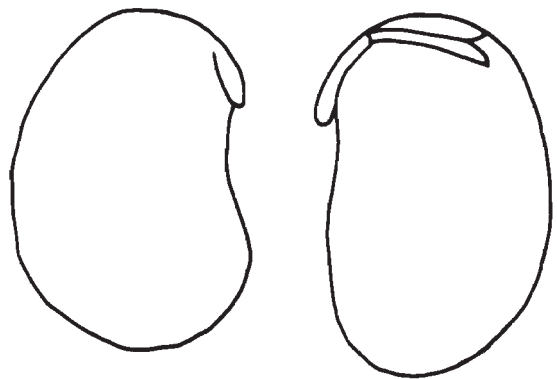
modified by a bloom; colored; mottled; with frequent mottles; brown; with brown (darker) overlay; glabrous; not smooth; with elevated features; wrinkled; chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum fully concealed; concealed by funicular remnant; larger than punctiform; 0.9–1.8 mm long; with curved outline; elliptic or oval; apical according to radicle tip but marginal according to seed length; flush; within corona. Hilum corona color lighter than testa. Lens discernible; equal to or greater than 0.5 mm in length; 1–2 mm long; with margins straight; linear; not in groove of raphe; confluent with hilum; flush; similar color as testa; darker than testa; brown; not within corona, halo, or rim. Endosperm absent. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing radicle; split over radicle; with lobes; with lobes touching (barely, auriculate); with the interface division terminating at base of radicle; with 1 margin recessed; recessed on same side as radicle; yellow to tan; inner face flat; glabrous around base of radicle. Embryonic axis oblique; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; linear; lobe tip straight; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule well developed; glabrous.

Distribution: Tropical and dry eastern Africa.

Notes: Verdcourt (1971) gave a more exact distribution for this genus.

Vatovaea: *V. pseudolablab* (H.A.T. Harms) J.B. Gillett (A–E). A, Fruits ($\times 1.9$); B, seeds ($\times 7.1$); C–D, testa ($\times 50$, $\times 1000$); E, embryos ($\times 8$).

0



Genus: *Decorsea* R. Viguier

Phylogenetic Number: 10.54.

Tribe: Phaseoleae.

Subtribe: Phaseolinae.

Species Studied—Species in Genus: 1 sp.—4 spp.

Fruit a legume; unilocular; $7\text{--}12 \times 0.5\text{--}0.8$ cm; with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight or curved (slightly); not plicate; not twisted; asymmetrical or symmetrical; linear or falcate; when asymmetrical with both sutures parallelly curved; not inflated; compressed; without beak; tapered at apex; apex oblique with longitudinal axis of fruit; short tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous; seed chambers barely visible or invisible externally; with the raised seed chambers not torulose. Fruit margin not constricted; without sulcus; embellished; with thickened sutural areas. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; assumed apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome; brown; pubescent but soon deciduous (from literature); puberulent; with simple hairs; eglandular; without spines; smooth; not veined; not tuberculate; not exfoliating; without cracks. Mesocarp thick; surface not veined; 1-layered; without balsamic vesicles; solid; coriaceous. Endocarp dull; monochrome; white; smooth; subseptate; with septa thin (tissue paper-like), flexible; with septa eglandular; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 5–11; length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; up to 0.7 mm long; of 1 length only; flattened; curved to triangular. Aril slightly fleshy to dry; when fleshy 2-lipped rim-aril; entire; covering less than 1/2 of seed; when dry 2-lipped rim-aril; entire; covering less than 1/2 of seed; with tongues (or flap-like) on lips of 2-lipped rim-aril; with 1 tongue or flap on 1 lip of 2-lipped rim-aril; cream.

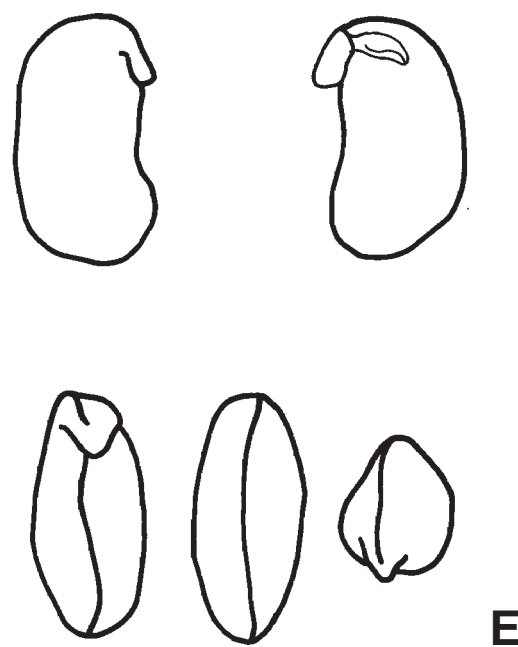
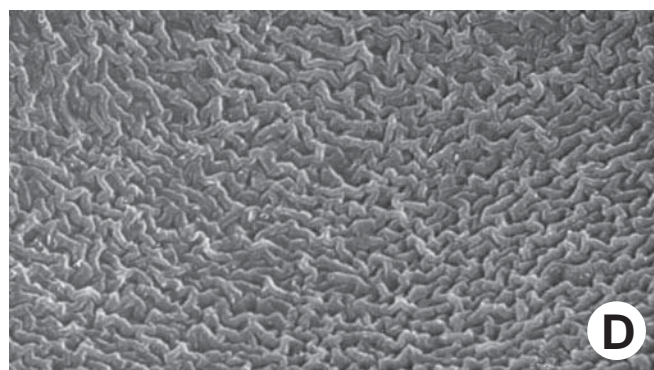
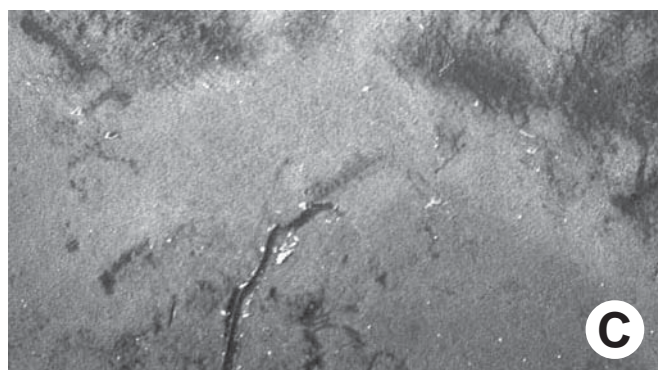
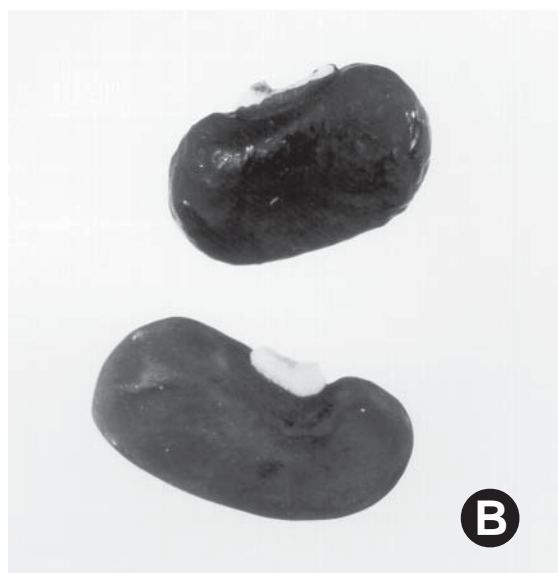
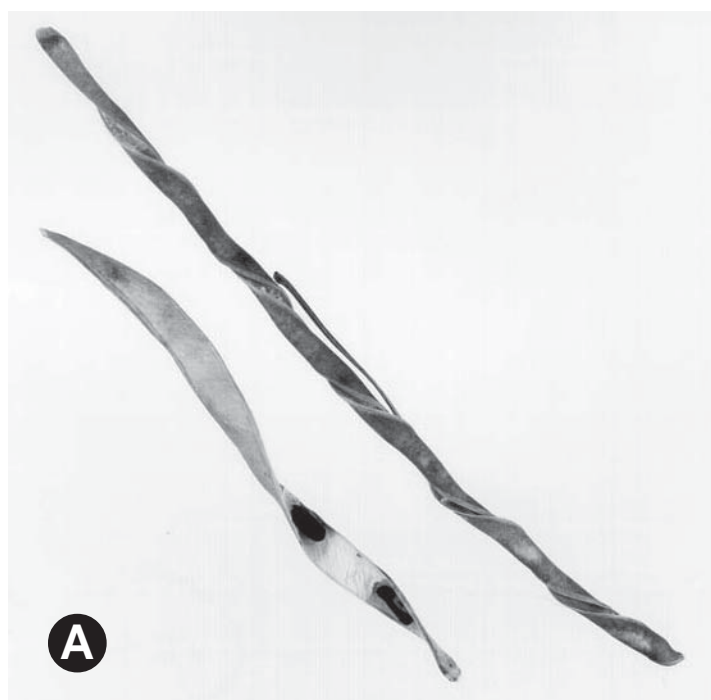
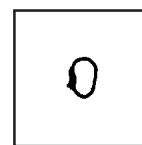
Seed $5.3\text{--}10.6 \times 3.9\text{--}5.5 \times 2\text{--}4.5$ mm; not overgrown; not angular; symmetrical or asymmetrical; ovate to reniform; compressed; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to

endocarp; dull; not modified by a bloom; colored; monochrome or mottled; with frequent mottles; brown; with brown (darker) overlay; glabrous; smooth; coriaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum partially or fully concealed; concealed by aril; without faboid split; larger than punctiform; 2.4–3.6 mm long; with curved outline; elliptic; apical according to radicle tip but marginal according to seed length; recessed; within rim or corona. Hilum corona color darker than testa. Hilum rim color darker than testa. Lens discernible; less than 0.5 mm to equal to or greater than 0.5 mm in length; up to 0.7 mm long; with margins straight; linear; not in groove of raphe; confluent with hilum; flush; same color as testa; brown; not within corona, halo, or rim. Endosperm apparently absent. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing radicle; notched at radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; pink; inner face flat; glabrous around base of radicle. Embryonic axis oblique; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; linear; lobe tip straight; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule well developed; glabrous.

Distribution: Southern and eastern Africa and Madagascar.

Notes: Verdcourt (1971) gave a more exact distribution for this genus.

Decorsea: *D. schlechteri* (H.A.T. Harms) B. Verdcourt (A–E). A, Fruits ($\times 1.1$); B, seeds ($\times 6.5$); C–D, testa ($\times 50$, $\times 1000$); E, embryos ($\times 5$).



Genus: *Spathionema* P.H.W. Taubert

Phylogenetic Number: 10.55.

Tribe: Phaseoleae.

Subtribe: Phaseolinae.

Species Studied—Species in Genus: 1 sp.—1 sp.

Fruit a legume; unilocular; $2.5\text{--}3.5 \times 0.9\text{--}1 \times 0.4$ cm; with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; slightly curved; not plicate; not twisted; asymmetrical; falcate; when asymmetrical with both sutures parallelly curved; not inflated; flattened to compressed; without or with beak; declined; with solid beak the same color and texture as fruit; rounded at apex; apex oblique with longitudinal axis of fruit; rounded at base; base oblique with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous; seed chambers externally invisible. Fruit margin not constricted; without sulcus; embellished; with thickened sutural areas. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome or multicolored; mottled; brown to tan; with brown overlay; glabrous; eglandular; without spines; not smooth; with elevated features; not veined; not tuberculate; wrinkled; not exfoliating; without cracks. Mesocarp thin; surface not veined; 2-layered; without balsamic vesicles; without fibers; with solid layer over solid layer; coriaceous. Endocarp dull to glossy; monochrome or mottled; tan to white; with mottling over seed chambers; with tan overlay; fibrous to smooth; nonseptate; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 2; length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; 1–1.2 mm long; of 1 length only; flattened; triangular. Aril dry; 2-lipped rim-aril; entire; with tongues (or flap-like) on lips of 2-lipped rim-aril; with 1 tongue or flap on 1 lip of 2-lipped rim-aril; cream.

Seed $8.5\text{--}10.7 \times 6.5\text{--}9.5 \times 1.5\text{--}3.5$ mm; not overgrown; not angular; symmetrical to asymmetrical; ovate; flattened; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; glossy to dull; not modified by a bloom; colored; mottled; with frequent or infrequent mottles; brown; with brown

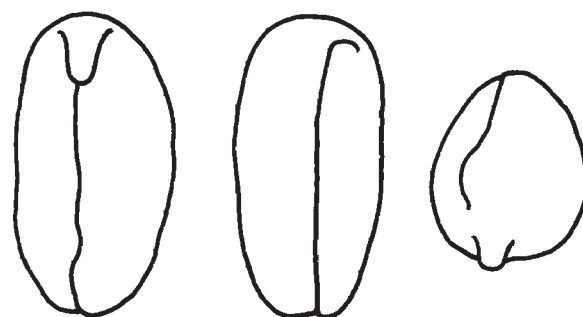
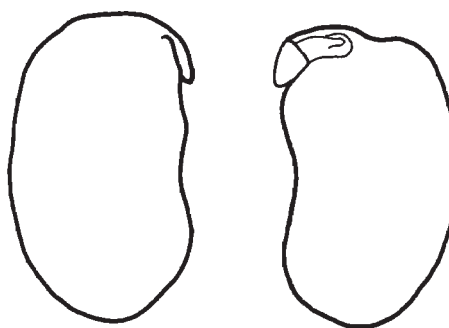
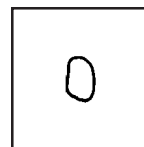
(darker) overlay; glabrous; smooth; chartaceous.

Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum partially concealed; concealed by aril; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 1.8–3 mm long; with curved outline; elliptic; apical according to radicle tip but marginal according to seed length; flush; within rim. Hilum rim color of or darker than testa. Lens discernible; equal to or greater than 0.5 mm in length; 1–1.8 mm long; with margins straight; linear; not in groove of raphe; confluent with hilum; recessed; same color as testa; brown; within rim. Lens rim color of testa. Endosperm absent. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing radicle; notched at radicle; without lobes; with the interface division terminating at base of radicle; with 1 margin recessed (slightly); recessed on same side as radicle; white; inner face flat; glabrous around base of radicle. Embryonic axis oblique; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; triangular; lobe tip straight; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

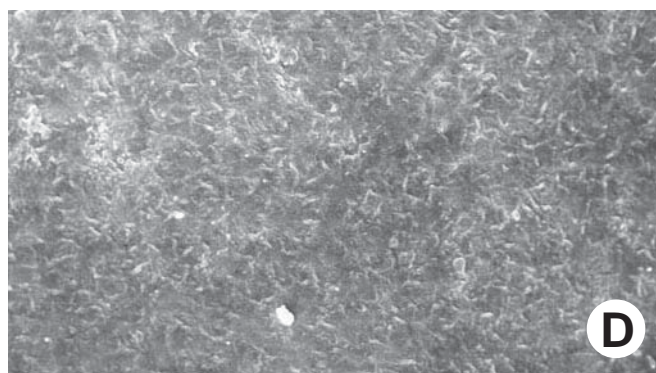
Distribution: Tropical eastern Africa.

Notes: Verdcourt (1971) gave a more exact distribution for this genus.

Spathionema: *S. kilimandscharicum* P.H.W. Taubert (A–E). A, Fruits ($\times 2.1$); B, seeds ($\times 5.6$); C–D, testa ($\times 50$, $\times 1000$); E, embryos ($\times 5$).



E



Genus: *Otoptera* A.-P. de Candolle

Phylogenetic Number: 10.56.

Tribe: Phaseoleae.

Subtribe: Phaseolinae.

Species Studied—Species in Genus: 1 sp.—2 spp.

Fruit a legume; unilocular; $7.7\text{--}10.5 \times 0.5\text{--}1.1$ cm; with persistent or deciduous calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; symmetrical; linear; not inflated; compressed; without beak; long tapered at apex; apex aligned with longitudinal axis of fruit; tapered to rounded at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous; seed chambers externally invisible. Fruit margin not constricted; without sulcus; embellished; with thickened sutural areas (slightly). Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome or multicolored; mottled; brown to tan; with brown overlay; with mottling over seed chambers; glabrous or pubescent and indurate; with 1 type of pubescence; puberulent; with pubescence golden; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; smooth or not smooth; with elevated features; not veined; not tuberculate; wrinkled; not exfoliating; with cracks; cracking oblique to fruit length. Mesocarp thick; surface not veined; 2-layered; with balsamic vesicles; without fibers; with solid layer over spongy layer; coriaceous. Endocarp dull; monochrome; tan to white; fibrous and scurfy; nonseptate; chartaceous; exfoliating in part; remaining fused to mesocarp and epicarp; entire. Seeds 4–8; length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; up to 0.6 mm long; of 1 length only; flattened; triangular. Aril dry; tiny, hippocrepiform rim-aril; entire; cream.

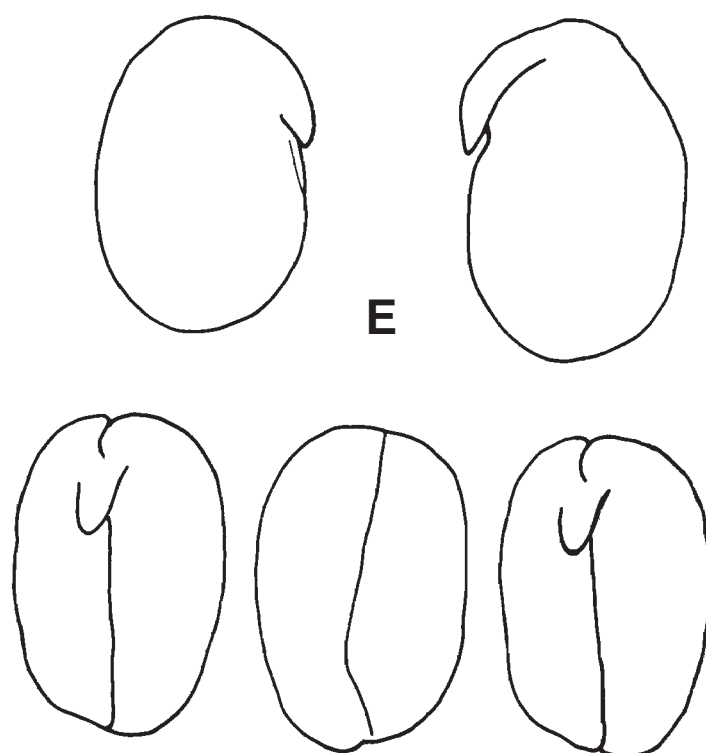
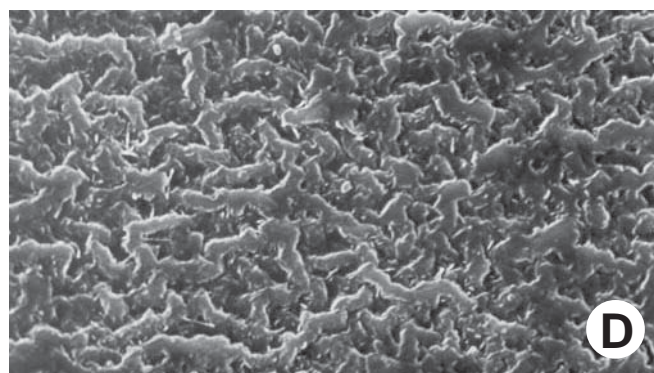
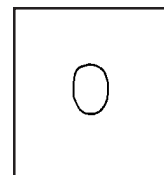
Seed $7\text{--}10 \times 4.8\text{--}5.8 \times 2.8\text{--}5.3$ mm; not overgrown; not angular; symmetrical; elliptic to oblong; terete to compressed; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; dull; not modified by a bloom; colored; monochrome or mottled; with frequent mottles; dark brown or brown;

with brown (darker) overlay; glabrous; smooth; coriaceous. Fracture lines absent. Rim absent. Wings absent. Raphe visible or not visible; from hilum through lens and base of seed to point opposite hilum; not bifurcating; color of testa; raised. Hilum fully concealed; concealed by funicular remnant; without faboid split; larger than punctiform; 0.7–1 mm long; with curved outline; elliptic; apical according to radicle tip but marginal according to seed length; recessed; within rim. Hilum rim color darker than testa. Lens discernible or not discernible; equal to or greater than 0.5 mm in length; 0.8–1 mm long; with margins straight; linear; not in groove of raphe; confluent with hilum; recessed; similar color as testa; lighter or darker than testa; brown; within rim. Lens rim color lighter or darker than testa. Endosperm absent. Cotyledons smooth or not smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; not concealing radicle; notched at radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; yellow; inner face flat; glabrous around base of radicle. Embryonic axis oblique; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; triangular; lobe tip straight; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Southern Africa.

Notes: Verdcourt (1971) gave a more exact distribution for this genus.

Otoptera: *O. burchellii* A.-P. de Candolle (A–E). A, Fruit ($\times 9.4$); B, seeds ($\times 6.3$); C–D, testa ($\times 50$, $\times 1000$); E, embryos ($\times 6$).



Genus: *Sphenostylis* E.H.F. Meyer

Phylogenetic Number: 10.57.

Tribe: Phaseoleae.

Subtribe: Phaseolinae.

Species Studied—Species in Genus: 4 spp.—7 spp.

Fruit a legume; unilocular; $8.5\text{--}15 \times 0.5\text{--}0.9$ cm; with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight or curved (slightly); not plicate; not twisted; symmetrical or asymmetrical; linear or falcate; when asymmetrical with both sutures parallelly curved; not inflated; flattened to compressed; without or with beak; straight to declined; with solid beak the same color and texture as fruit; long tapered to tapered at apex; apex aligned or oblique with longitudinal axis of fruit; short tapered to rounded at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous; seed chambers externally invisible; with the raised seed chambers not torulose. Fruit margin not constricted; without sulcus; plain or embellished; with thickened (slightly) sutural areas or ridges. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome or multicolored; mottled; brown; with brown overlay; with mottling over seed chambers; glabrous or pubescent but soon deciduous; with hairs appressed; with 1 type of pubescence; with pubescence golden; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases swollen; eglandular; without spines; not smooth; with elevated features; not veined; not tuberculate; dotted; not exfoliating; without cracks. Mesocarp thick; surface not veined; 2-layered; without balsamic vesicles; without fibers; with spongy layer over solid layer; coriaceous. Endocarp dull; monochrome or mottled; tan; with mottling (dark); with brown overlay; cobwebby and scurfy; septate; with septa thin (tissue paper-like), flexible to thicker than paper, firm; with septa eglandular; chartaceous; exfoliating in part; remaining fused to mesocarp and epicarp; entire. Seeds 5–15; length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus less than 0.5 mm long or measured; up to 0.6 mm long; of 1 length only; thick; straight. Aril dry; rim-aril and tongue-aril or hippo-crepiform rim-aril; entire; cream.

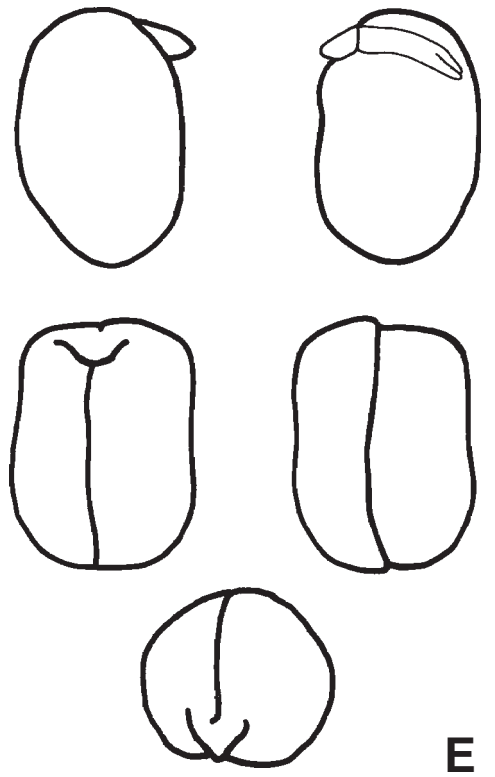
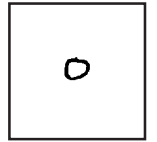
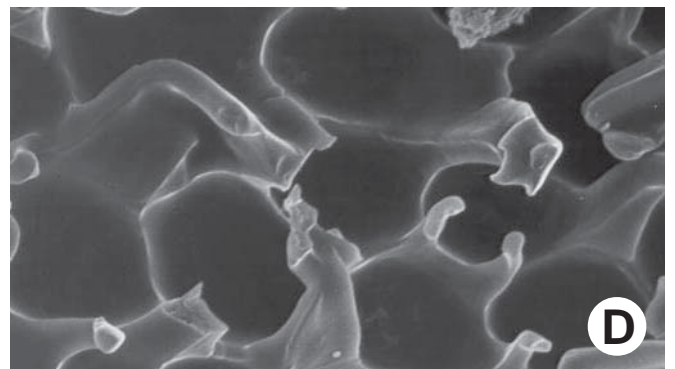
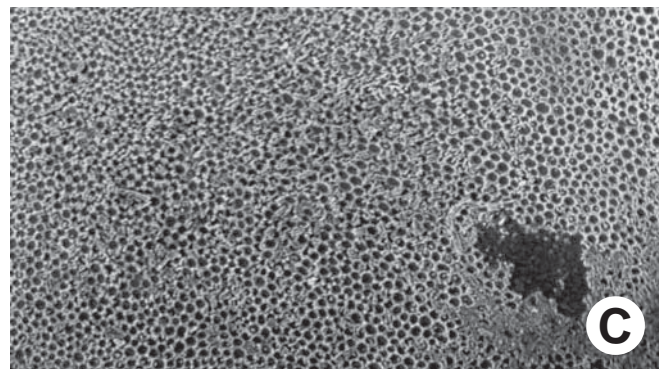
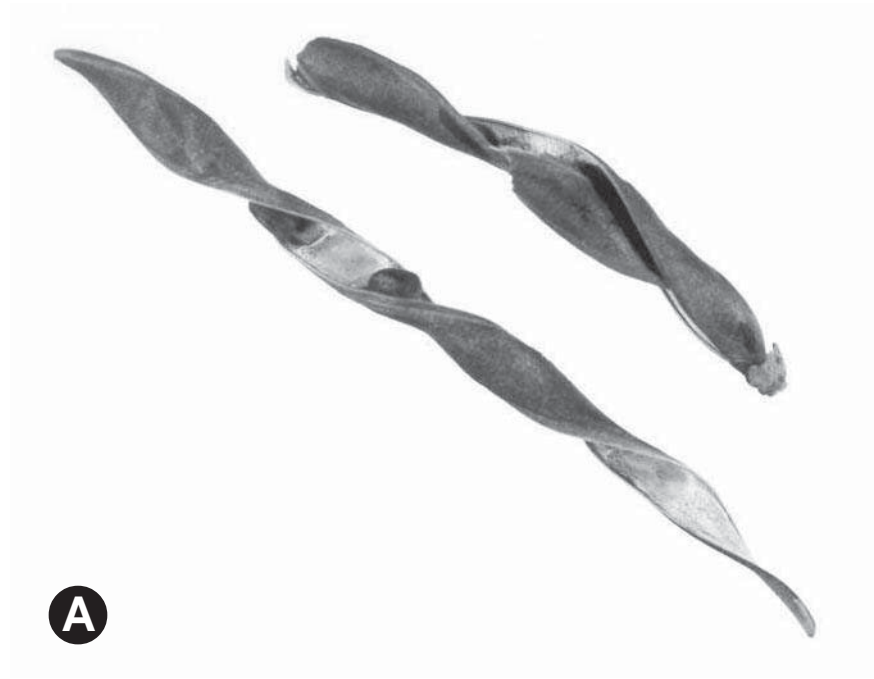
Seed $3.5\text{--}12.2 \times 3\text{--}6.5 \times 2\text{--}6.5$ mm; not overgrown; angular or not angular; symmetrical; circular, D-shaped, or oblong; terete or compressed; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering or partially adhering to endocarp; dull; not modified by a bloom; colored; monochrome or mottled; with infrequent mottles; black to brown (or dark brown); with black or brown (darker) overlay; glabrous; smooth or not smooth; with elevated features; reticulate, rugose, or papillate; chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe from hilum through lens and base of seed to point opposite hilum; not bifurcating; color of testa; brown; raised. Hilum partially or fully concealed; concealed by aril; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 1–3 mm long; with curved outline; elliptic; apical according to radicle tip but marginal according to seed length; flush; not within corona, halo, or rim or within rim. Hilum rim color of testa. Lens discernible; equal to or greater than 0.5 mm in length; 0.5–2.2 mm long; with margins straight or curved; linear, circular, or elliptic; not in groove of raphe; confluent with hilum; mounded, flush, or recessed; same color as testa; dark brown; not within corona, halo, or rim. Endosperm present or absent; trace; restricted to region of embryo; adnate to testa. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; not concealing radicle; notched at radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; yellow or pink; inner face flat; glabrous around base of radicle. Embryonic axis straight, oblique, or right angled; perpendicular to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; bulbous or triangular; lobe tip straight; oblique to cotyledons or deflexed and parallel to cotyledon width; centered between cotyledons; less than 1/2 length of cotyledons. Plumule well developed; glabrous.

Distribution: Tropical and southern Africa.

Notes: Potter and Doyle (1994) developed phylogenetic hypotheses for *Sphenostylis* and altered the generic circumscription accordingly. Their species count and distribution were used. *Sphenostylis stenocarpa*, the African yam bean, has distinct wild and cultivated forms (Potter 1992). The cultivated type has larger fruit

with delayed dehiscence and larger seeds with smooth testa. Wild type seeds are smaller with black, waxy elaborations on the testa, also found in other species.

Sphenostylis: *S. stenocarpa* (C.F. Hochstetter ex A. Richard) H.A.T. Harms (*C–E*), *S. spp.* (*A–B*). *A*, Fruits ($\times 1.3$); *B*, seeds ($\times 5.3$); *C–D*, testa ($\times 50$, $\times 1000$); *E*, embryos ($\times 8$).



Genus: *Nesphostylis* B. Verdcourt

Phylogenetic Number: 10.58.

Tribe: Phaseoleae.

Subtribe: Phaseolinae.

Species Studied—Species in Genus: 1 sp.—3 spp.

Fruit a legume; unilocular; $10\text{--}15 \times 0.75\text{--}0.9$ cm; with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; symmetrical; linear; not inflated; flattened; without beak; tapered at apex; apex aligned with longitudinal axis of fruit; short tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; seed chambers externally invisible. Fruit margin not constricted; without sulcus; embellished; with thickened sutural areas. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves assumed along both sutures; assumed apical and down; assumed active; assumed with valves twisting. Epicarp pubescent and indurate; velutinous; with pubescence gray to brown; not tuberculate. Aril fleshy; hippocrepiform rim-aril (thick at connected end); entire; covering less than 1/2 of seed; brown, cream, or orange.

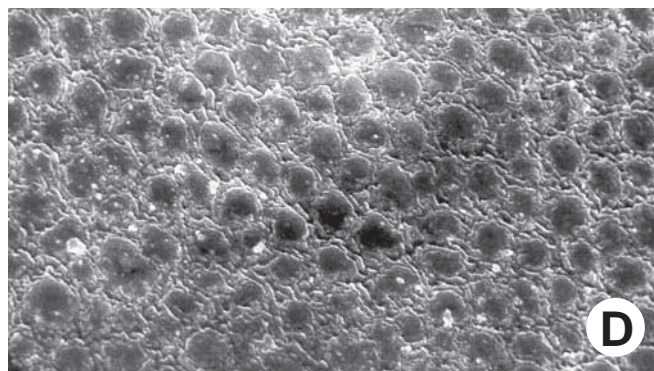
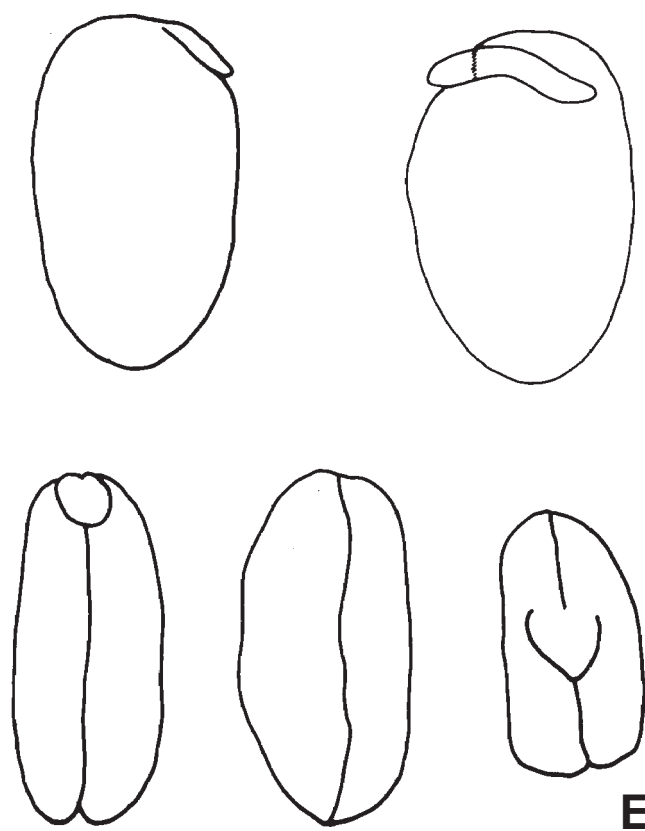
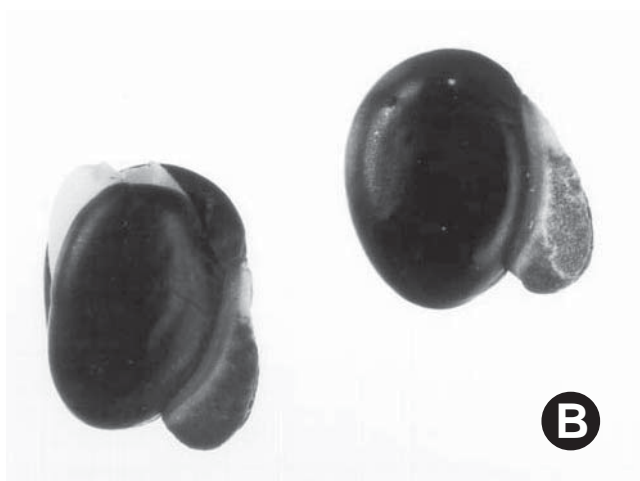
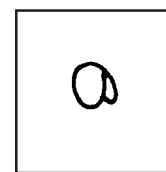
Seed $5.5\text{--}8 \times 4\text{--}5 \times 2.5\text{--}3.2$ mm; not overgrown; not angular; symmetrical; ovate; compressed; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; dull; not modified by a bloom; colored; monochrome; dark brown; glabrous; not smooth; with elevated features; wrinkled; coriaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum partially to fully concealed; concealed by funicular remnant and aril; without faboid split; larger than punctiform; $5\text{--}6.3$ mm long; with straight outline; linear; marginal according to radicle tip; flush; not within corona, halo, or rim. Lens discernible; less than 0.5 mm in length; with margins straight; linear; not in groove of raphe; confluent with hilum; flush; same color as testa; black to brown; not within corona, halo, or rim. Endosperm absent. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing radicle; notched at radicle; without lobes; with the interface division terminating at

base of radicle; without margins recessed; yellowish white; inner face flat; glabrous around base of radicle. Embryonic axis right angled; perpendicular to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; bulbous; lobe tip straight; deflexed and parallel to cotyledon width; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Africa (1 sp.), India (1 sp.), and Burma (1 sp.).

Notes: Potter and Doyle (1994) developed phylogenetic hypotheses for *Nesphostylis* and altered the generic circumscription accordingly. Their species count and distribution were used. No fruit was dissected, and only one seed was studied. Some data were taken from Verdcourt (1970a).

Nesphostylis: *N. holosericea* (J.G. Baker) B. Verdcourt (A–E). A, Fruit ($\times 1.1$); B, seeds ($\times 7.2$); C–D, testa ($\times 50$, $\times 1000$); E, embryos ($\times 8$).



Genus: *Austrodolichos* B. Verdcourt

Phylogenetic Number: 10.59.

Tribe: Phaseoleae.

Subtribe: Phaseolinae.

Species Studied—Species in Genus: 1 sp.—1 sp.

Fruit a legume; unilocular; $7.5-8 \times 0.7$ cm; with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; symmetrical; linear; not inflated; compressed; without beak; long tapered at apex; apex oblique with longitudinal axis of fruit; short tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; ligneous; seed chambers externally invisible. Fruit margin not constricted; without sulcus; plain. Fruit wings absent. Fruit substipitate. Fruit with all layers dehiscent. Dehiscence of valves along both sutures; assumed apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome; dark brown; pubescent and indurate; with 1 type of pubescence; puberulent; with pubescence uniformly distributed; with simple hairs; with hair bases swollen; eglandular or glandular; with glandular hairs; without spines; not smooth; with elevated features; not veined; not tuberculate; papillose; not exfoliating; without cracks. Mesocarp thick; 1-layered; without balsamic vesicles; without fibers; subligneous. Endocarp dull; monochrome; tan; smooth; septate; with septa eglandular; not exfoliating. Seeds 8–9; length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; 0.5 mm long; of 1 length only; thick; straight. Aril fleshy; hippocrepiform rim-aril (bulbous at base); entire; covering less than 1/2 of seed; tan.

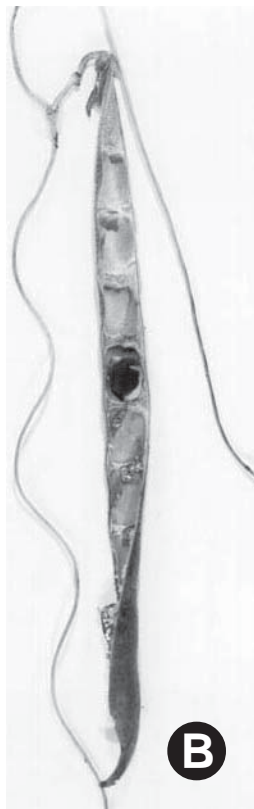
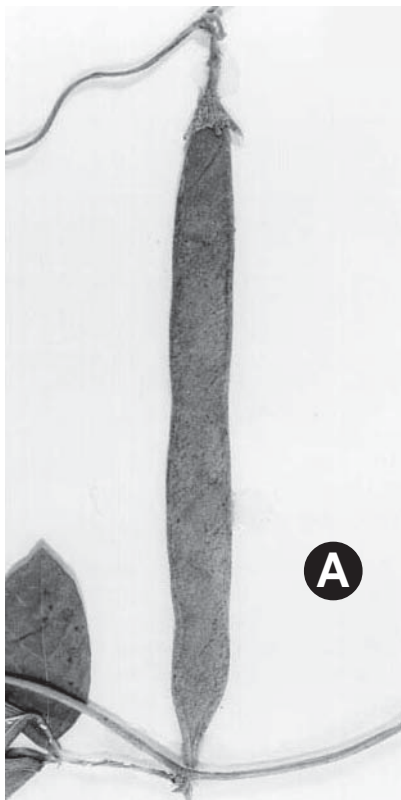
Seed $5.2-6.4 \times 3.3-4 \times 2.4-2.8$ mm; not overgrown; not angular; asymmetrical; ovate; compressed; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; dull; not modified by a bloom; colored; mottled; with frequent mottles; brown; with brown (darker) overlay; glabrous; not smooth; coriaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum fully concealed; concealed by aril; without faboid split; larger than punctiform; 3–4.2 mm long; with curved outline; elliptic; apical according to radicle tip but marginal

according to seed length; recessed; within corona. Hilum corona color darker than testa. Lens discernible; less than 0.5 mm in length; with margins straight; linear; not in groove of raphe; confluent with hilum; flush; similar color as testa; lighter than testa; brown; within corona. Lens corona color lighter than testa. Endosperm apparently absent. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing radicle; notched at radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; yellowish white; inner face flat; glabrous around base of radicle. Embryonic axis oblique; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; triangular; lobe tip straight; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule moderately to well developed; glabrous.

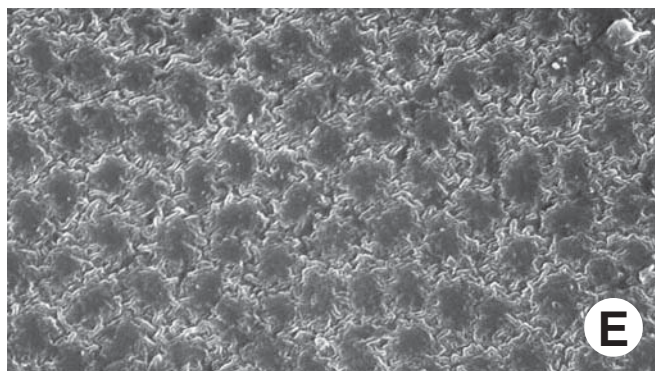
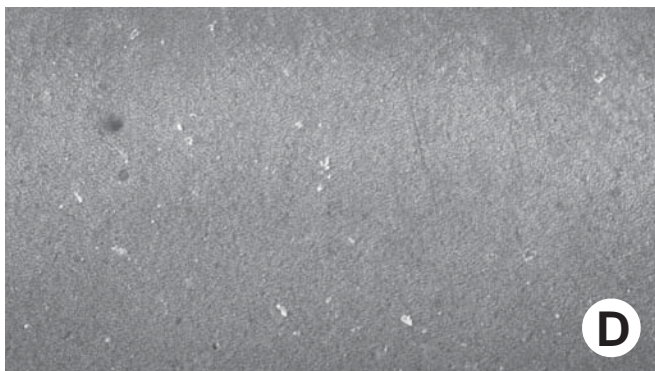
Distribution: Australia.

Austrodolichos: *A. errabundus* (M. Schott) B. Verdcourt (A–F). A–B, Fruits ($\times 1.2$, $\times 1.3$); C, seeds ($\times 6.6$); D–E, testa ($\times 50$, $\times 1000$); F, embryos ($\times 6$).

0



F



Genus: *Neorautanenia* H. Schinz

Phylogenetic Number: 10.60.

Tribe: Phaseoleae.

Subtribe: Phaseolinae.

Species Studied—Species in Genus: 2 spp. —3 spp.

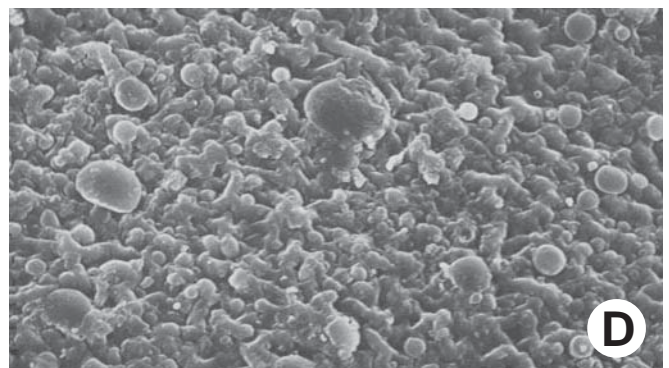
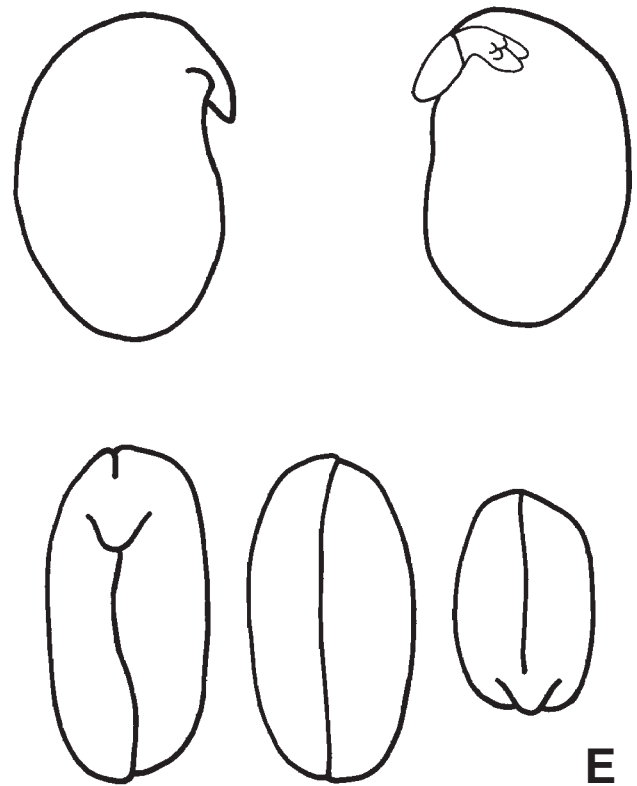
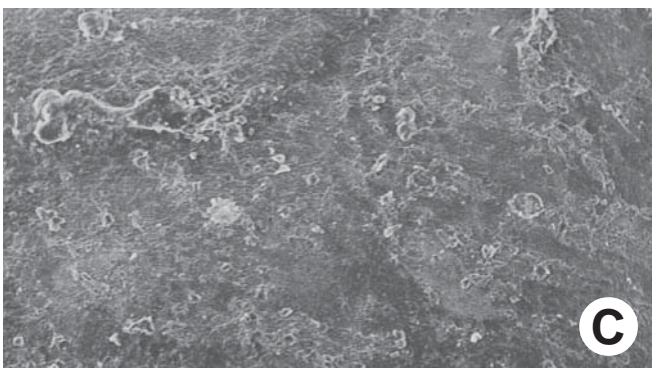
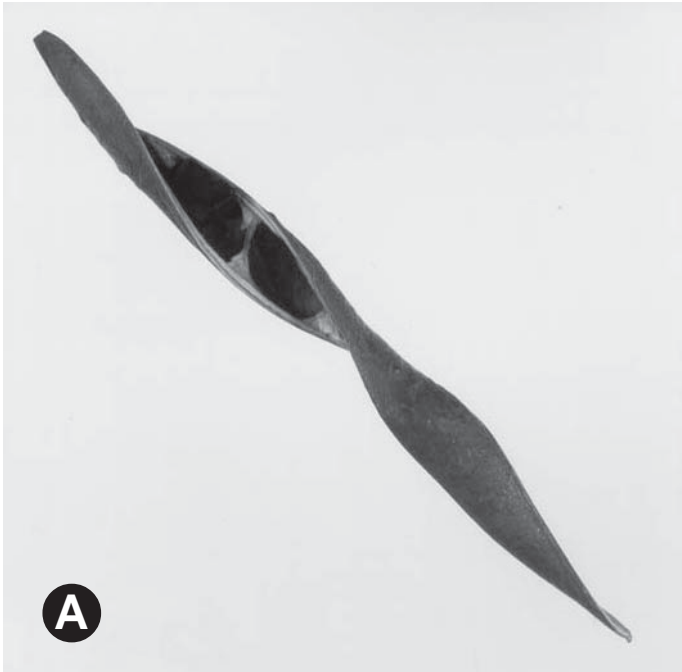
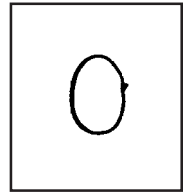
Fruit a legume; unilocular; $7.5\text{--}11.5 \times 1\text{--}1.7$ cm; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; symmetrical; linear; not inflated; compressed to terete; without beak; long tapered to tapered at apex; apex aligned with longitudinal axis of fruit; tapered to short tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous to leathery; seed chambers externally invisible to visible (slightly); with the raised seed chambers not torulose. Fruit margin not constricted; without sulcus; plain or embellished; with thickened (slightly) sutural areas. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome or multicolored; mottled; tan to brown; with brown overlay; with mottling over seed chambers; pubescent and indurate; with 1 type of pubescence; puberulent to velutinous (shortly); with pubescence golden to white; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; smooth; not veined; not tuberculate; not exfoliating; with cracks; cracking oblique to fruit length. Mesocarp thick; surface not veined; 1-layered; without or with balsamic vesicles; without fibers; solid; subligneous. Endocarp dull; monochrome or mottled; tan or white; with mottling over seed chambers; with brown overlay; cobwebby, fibrous, and scurfy; subseptate; with septa thin (tissue paper-like), flexible; with septa eglandular; chartaceous; exfoliating in part; remaining fused to mesocarp and epicarp; entire. Seeds 5–8; length parallel with or transverse to fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; up to 1.5 mm long; of 1 length only; thick; straight. Aril dry; 2-lipped rim-aril or hippocrepiform rim-aril; fimbriate; with tongues (or flap-like) on lips of 2-lipped rim-aril; with 1 tongue or flap on 1 lip of 2-lipped rim-aril or 2 tongues or flaps, 1 on each lip of 2-lipped rim-aril; cream.

Seed $8\text{--}14.5 \times 7\text{--}11 \times 4.3\text{--}7.5$ mm; not overgrown; not angular or angular (slightly); symmetrical or asymmetrical; irregular to oblong to ovate; compressed; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering or partially adhering to endocarp; dull; not modified by a bloom; colored; monochrome; brown; glabrous; not smooth; with recessed or recessed and elevated features; wrinkled; pitted with small separate pits; coriaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum partially concealed; concealed by funicular remnant; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 2.7–4.3 mm long; with curved outline; elliptic to oval; apical according to radicle tip but marginal according to seed length; recessed; within rim. Hilum rim color of or darker than testa. Lens discernible; equal to or greater than 0.5 mm in length; 1.7–2.8 mm long; with margins curved; ovate; not in groove of raphe; confluent with hilum; mounded; similar color as testa; darker than testa; black to brown; within rim. Lens rim color of or darker than testa. Endosperm absent. Cotyledons smooth or not smooth; wrinkled; both outer faces convex; both the same thickness or 1 thicker than the other (rarely); both more or less of equal length or 1 longer than other (rarely); not folded; margin entire 180 degrees from base of radicle; similar at apex; completely concealing radicle; notched at radicle; with or without lobes; with lobes not touching; with basal groin formed by lobes; with the interface division terminating at base of radicle; without or with both margins recessed; yellowish white or tan; inner face flat; glabrous around base of radicle. Embryonic axis oblique or right angled; parallel or oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; bulbous; lobe tip straight; deflexed and parallel to cotyledon width or oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule moderately or well developed; glabrous.

Distribution: Africa.

Notes: Lackey (1981b) spelled the name of this genus '*Neurautanenia*,' but the correct spelling is *Neorautanenia*.

Neorautanenia: *N. amboensis* H. Schinz (A, C–E), *N. spp.* (B). A, Fruit ($\times 1$); B, seeds ($\times 3.6$); C–D, testa ($\times 50$, $\times 1000$); E, embryos ($\times 3$).



Genus: *Lablab* M. Adanson

Phylogenetic Number: 10.61.

Tribe: Phaseoleae.

Subtribe: Phaseolinae.

Species Studied—Species in Genus: 1 sp.—1 sp.

Fruit a legume; unilocular; $3.7\text{--}5 \times 1.6\text{--}1.8 \times 0.6\text{--}0.8$ cm; with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight or curved (slightly); not plicate; not twisted; asymmetrical; irregular; when asymmetrical with 1 straight and 1 curved suture or both sutures unequally curved; widest near middle or D-shaped; not inflated; compressed; with beak; hooked; with solid beak the same color and texture as fruit; short tapered at apex; apex oblique with longitudinal axis of fruit; tapered or short tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; chartaceous to coriaceous; seed chambers externally visible or invisible; with the raised seed chambers not torulose. Fruit margin not constricted; without sulcus; embellished; with thickened sutural areas or thickened sutural areas and prickles. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome; tan; pubescent and indurate; with 1 type of pubescence; short puberulent; with pubescence white; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; not smooth; with elevated features; reticulately veined; not tuberculate; verrucose-rugose; not exfoliating; without cracks. Mesocarp trace; surface not veined; 1-layered; without balsamic vesicles; solid; chartaceous. Endocarp glossy; monochrome; tan to white; smooth; subseptate; with septa thin (tissue paper-like), flexible; with septa eglandular; chartaceous; exfoliating in part; remaining fused to mesocarp and epicarp; entire. Seeds 2–4; length oblique to fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; up to 2 mm long; of 1 length only; flattened; triangular. Aril fleshy; hippocrepiform rim-aril; fimbriate; covering less than 1/2 of seed; with tongues (or flap-like) on lips of 2-lipped rim-aril; with 1 tongue or flap on 1 lip of 2-lipped rim-aril; cream.

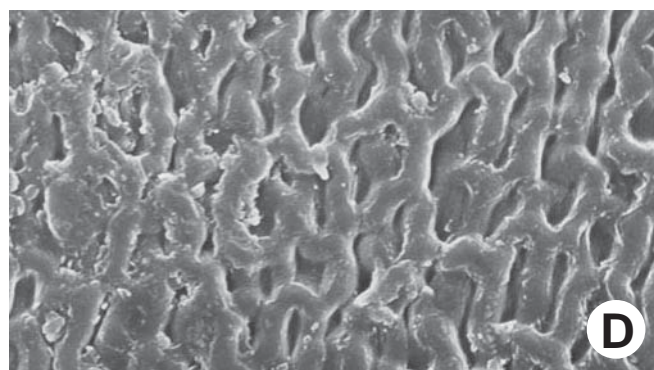
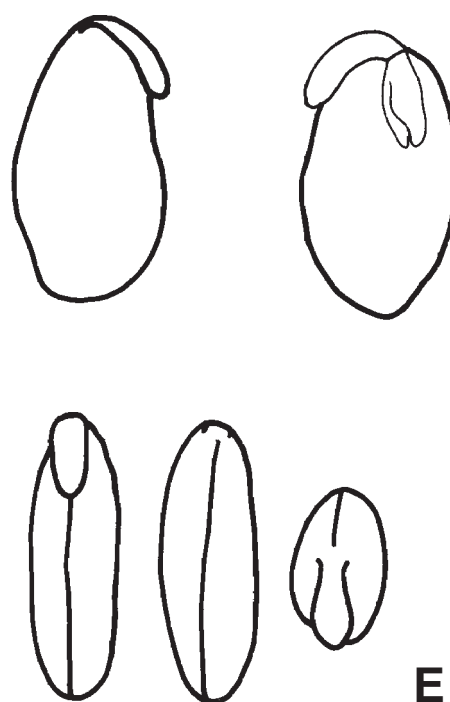
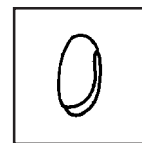
Seed $8\text{--}18 \times 5.5\text{--}11.5 \times 3.8\text{--}7.5$ mm; not overgrown; not angular; asymmetrical; elliptic to irregular to ovate; nearly terete to compressed; with surface smooth; with visible radicle and cotyledon lobes; without external groove between radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; dull; not modified by a bloom; colored; monochrome or mottled; with infrequent mottles; brown or cream; with brown (darker) overlay; glabrous; smooth; coriaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum fully concealed; concealed by aril; without faboid split; larger than punctiform; 8–12.5 mm long; with straight outline; linear; marginal according to radicle tip; recessed; within corona or not within corona, halo, or rim. Hilum corona color darker than testa. Lens discernible; equal to or greater than 0.5 mm in length; 1.8–2 mm long; with margins straight or curved; linear or elliptic; not in groove of raphe; confluent with hilum; mounded; similar color as or dissimilar color from testa; darker than testa; brown or tan; within rim. Lens rim color of or darker than testa. Endosperm absent. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing radicle; notched at radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; white to tan to brown; inner face flat; glabrous around base of radicle. Embryonic axis oblique; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; bulbous; lobe tip curved; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule well developed; glabrous.

Distribution: Africa and widely cultivated.

Notes: This genus is grown in tropical and subtropical areas.

The young pods and dried seeds are used for human food, and the whole plants for forage and green manure (Duke 1981, Maesen and Somaatmadja 1989). The plants are prolific nodulators.

Lablab: *L. purpureus* (C. Linnaeus) R. Sweet (A–E). A, Fruits ($\times 1.8$); B, seeds ($\times 2.3$); C–D, testa ($\times 50$, $\times 1000$); E, embryos ($\times 3$).



Genus: *Alistilus* N.E. Brown

Phylogenetic Number: 10.62.

Tribe: Phaseoleae.

Subtribe: Phaseolinae.

Species Studied—Species in Genus: 1 sp.—3 spp.

Fruit a legume; unilocular; $4.7 \times 0.7 \times 0.35$ cm; without orifice formed by curving of fruit or fruit segments; curved; not plicate; not twisted; asymmetrical; falcate; when asymmetrical with both sutures parallelly curved; not inflated; compressed; without beak; tapered at apex; apex right-angled with longitudinal axis of fruit; tapered at base; base oblique with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous; seed chambers externally visible (barely); with the raised seed chambers not torulose. Fruit margin not constricted; without sulcus; embellished; with thickened sutural areas. Fruit wings absent. Fruit substipitate; with the stipe 3 mm long. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Epicarp dull; multicolored; bichrome; brown and tan; pubescent and indurate; with 1 type of pubescence; short puberulent; with pubescence golden; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; not smooth; with elevated features; not veined; not tuberculate; rugose; not exfoliating; with cracks; cracking oblique to fruit length. Mesocarp present. Seeds ca. 4; length assumed parallel with fruit length; assumed neither overlapping nor touching; assumed in 1 series. Aril dry; rim- and tongue-aril; entire; cream.

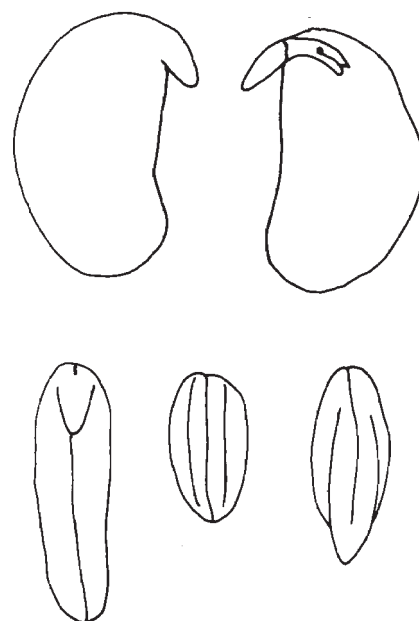
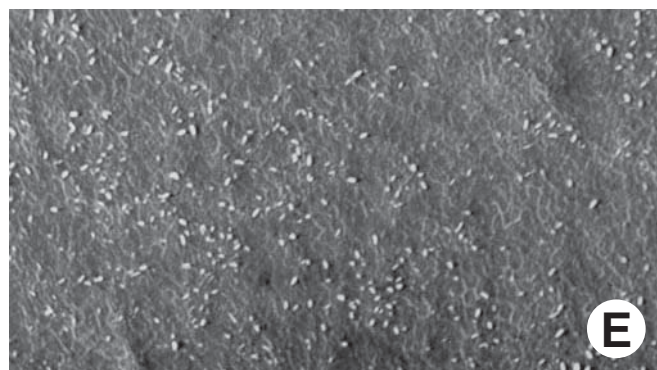
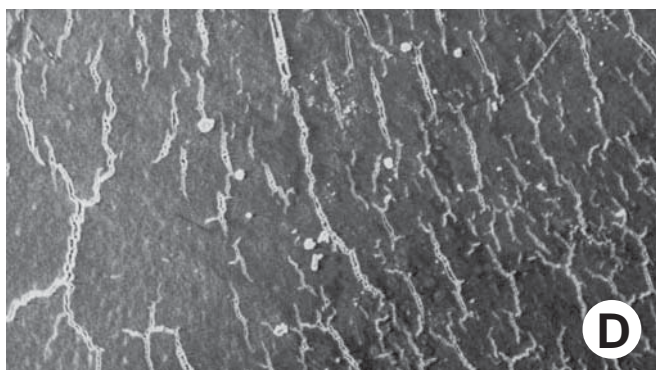
Seed $6.5\text{--}8 \times 4.5\text{--}5.4 \times 1.9\text{--}2.8$ mm; not overgrown; not angular; symmetrical; reniform; compressed; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; glossy; not modified by a bloom; colored; mottled; with frequent mottles; brown; with brown (darker) overlay; glabrous; smooth; coriaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum partially concealed; concealed by aril; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; $2\text{--}2.3$ mm long; with curved outline; elliptic; apical according to radicle tip but marginal according to seed length; recessed; within corona. Hilum corona color darker than testa. Lens

discernible; equal to or greater than 0.5 mm in length; 1 mm long; with margins straight; linear; not in groove of raphe; confluent with hilum; flush; similar color as testa; darker than testa; brown; within corona. Lens corona color darker than testa. Endosperm apparently absent. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing radicle; notched at radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; white; inner face flat; glabrous around base of radicle. Embryonic axis oblique; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; bulbous; lobe tip straight; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule well developed; glabrous.

Distribution: Southern tropical Africa and Madagascar.

Notes: Verdcourt (1981) described a new species from Madagascar, *A. magnificus* B. Verdcourt, which increased to three the number of species in this genus.

Alistilus: *A. bechuanicus* N.E. Brown (A), *A. spp.* (B–F).
A–B, Fruit ($\times 2$, $\times 2.1$); C, seeds ($\times 6.8$); D–E, testa ($\times 50$, $\times 1000$); F, embryos ($\times 4.5$).



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Genus: *Dipogon* F.M. Liebmann

Phylogenetic Number: 10.63.

Tribe: Phaseoleae.

Subtribe: Phaseolinae.

Species Studied—Species in Genus: 1 sp.—1 sp.

Fruit a legume; unilocular; $3\text{--}4.5 \times 0.5\text{--}0.9$ cm; with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; slightly curved; not plicate; not twisted; asymmetrical; slightly falcate; when asymmetrical with both sutures parallelly curved; not inflated; compressed; with beak; declined; with solid beak the same color and texture as fruit; short tapered at apex; apex oblique with longitudinal axis of fruit; tapered at base; base oblique with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous; seed chambers externally invisible. Fruit margin not constricted; without sulcus; embellished; with thickened sutural areas. Fruit wings absent. Fruit substipitate; with the stipe 2–3 mm long. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; multicolored; mottled; orange; with brown overlay; with mottling over seed chambers; glabrous; eglandular; without spines; smooth or not smooth; not veined; not tuberculate; not exfoliating; without or with cracks; cracking oblique to fruit length. Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; solid; chartaceous. Endocarp dull; monochrome; tan; smooth; septate; with septa thin (tissue paper-like), flexible; with septa eglandular; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 3–5; length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; up to 1 mm long; of 1 length only; flattened; straight. Aril fleshy; hippo-crepiform rim-aril; entire; covering less than 1/2 of seed; with tongues (or flap-like) on lips of 2-lipped rim-aril; with 1 tongue or flap on 1 lip of 2-lipped rim-aril; cream.

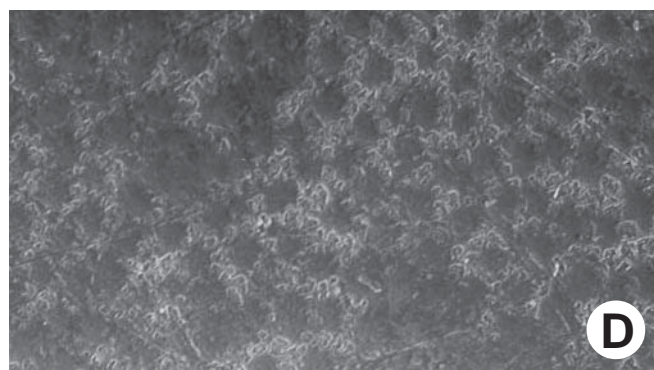
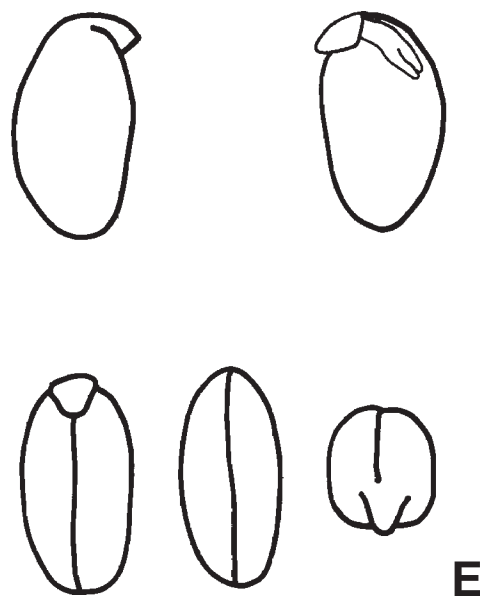
Seed $4.1\text{--}7.1 \times 3.5\text{--}5 \times 3\text{--}3.7$ mm; not overgrown; angular; symmetrical; elliptic to ovate; terete; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; dull; not modified by a bloom; colored; mottled; with frequent mottles; brown;

with brown (darker) overlay; glabrous; smooth; chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum fully concealed; concealed by aril; without faboid split; larger than punctiform; 3–3.8 mm long; with straight outline; linear; marginal according to radicle tip; flush; within corona. Hilum corona color darker than testa. Lens barely discernible; equal to or greater than 0.5 mm in length; up to 1 mm long; with margins straight; linear; not in groove of raphe; confluent with hilum; flush; similar color as testa; darker than testa; brown; within rim. Lens rim color darker than testa. Endosperm apparently absent. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing radicle; notched at radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; yellowish white; inner face flat; glabrous around base of radicle. Embryonic axis oblique; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; linear; lobe tip curved; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule well developed; glabrous.

Distribution: South Africa; cultivated elsewhere.

Dipogon: *D. lignosus* (C. Linnaeus) B. Verdcourt (A–E). A, Fruit ($\times 2.3$); B, seeds ($\times 6.7$); C–D, testa ($\times 50$, $\times 1000$); E, embryos ($\times 5$).

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Genus: *Dolichos* C. Linnaeus

Phylogenetic Number: 10.64.

Tribe: Phaseoleae.

Subtribe: Phaseolinae.

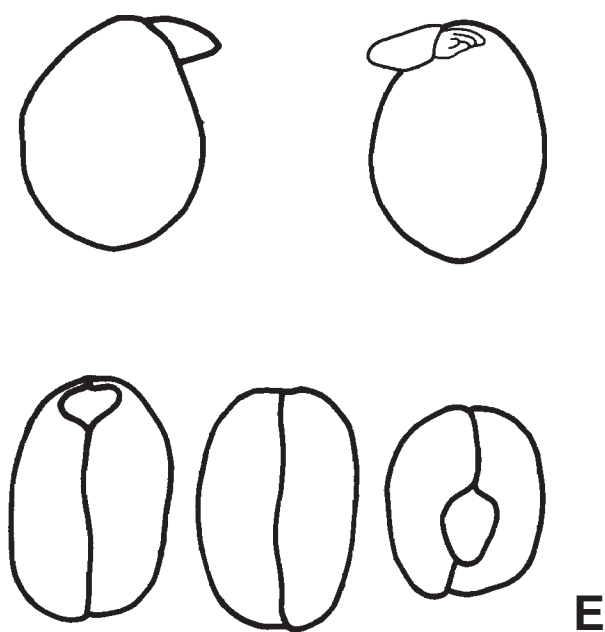
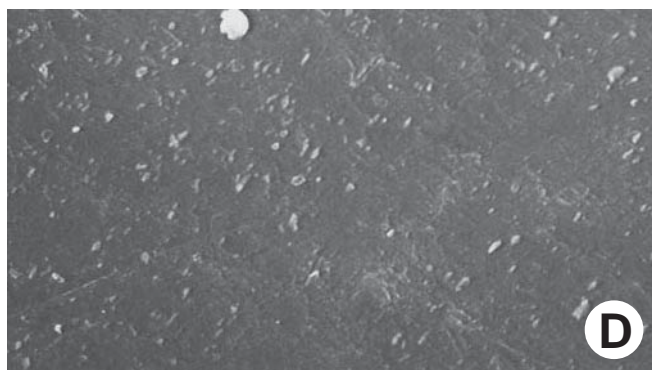
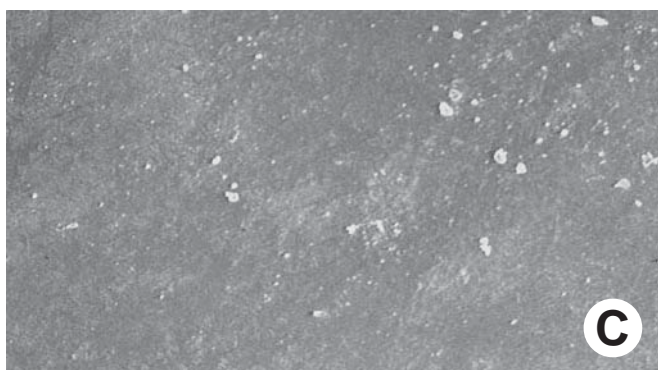
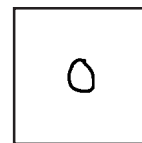
Species Studied—Species in Genus: 12 spp.—60 spp.

Fruit a legume; unilocular; $1.5\text{--}7 \times 0.6\text{--}1.4$ cm; with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; asymmetrical or symmetrical; linear or falcate; when asymmetrical with 1 straight and 1 curved suture or both sutures parallelly curved; widest near middle or D-shaped; not inflated; compressed; with beak; declined; with solid beak the same color and texture as fruit; tapered or short tapered at apex; apex aligned or oblique with longitudinal axis of fruit; short tapered or rounded at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous or leathery; seed chambers externally invisible. Fruit margin not constricted; without sulcus; plain or embellished; with thickened sutural areas. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome; brown to tan; glabrous or pubescent and indurate; with 1 type of pubescence; pilose or puberulent; with pubescence golden; with simple hairs; pliable; with hair bases plain; eglandular; without spines; smooth or not smooth; with elevated features; not veined; not tuberculate; wrinkled; not exfoliating; without cracks. Mesocarp thick or thin; surface not veined; 1- or 2-layered; without balsamic vesicles; without fibers; solid; with vitreous layer over solid layer; coriaceous. Endocarp dull; monochrome; brown to tan; smooth; septate; with septa thin (tissue paper-like), flexible or thicker than paper, firm; with septa eglandular; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 2–11; length parallel with or transverse to fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; up to 1 mm long; of 1 length only; flattened; triangular. Aril fleshy or dry; when fleshy hippo-crepiform rim-aril; entire; covering less than 1/2 of seed; when dry 2-lipped rim-aril; entire; covering less than 1/2 of seed; with tongues (or flap-like) on lips of 2-lipped rim-aril; with 1 tongue or flap on 1 lip of 2-lipped rim-aril; cream.

Seed $3.3\text{--}9.5 \times 3\text{--}6.1 \times 2\text{--}5$ mm; not overgrown; angular or not angular; symmetrical or asymmetrical; circular to elliptic to irregular to reniform; terete to compressed; with surface smooth; without or with visible radicle and cotyledon lobes; without external groove between radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; glossy to dull; not modified by a bloom; colored; monochrome or mottled; with frequent mottles; black to brown; with brown (darker) overlay; glabrous; smooth or not smooth; with elevated features; wrinkled; chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe barely visible or not visible; from hilum through lens to base of seed and terminating; not bifurcating; darker than testa; dark brown; flush or raised (slightly). Hilum visible or partially concealed; concealed by aril; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 1.8–5 mm long; with curved to straight outline; narrowly elliptic, oval (narrowly), or linear; apical according to radicle tip but marginal according to seed length; flush; within corona or not within corona, halo, or rim. Hilum corona color darker than testa. Lens discernible; equal to or greater than 0.5 mm in length; 0.5–1.4 mm long; with margins straight; linear; not in groove or in groove of raphe; confluent with hilum; flush; similar color as testa; darker than testa; black to brown; within rim or corona. Lens corona color darker than testa. Lens rim color of testa. Endosperm apparently absent. Cotyledons smooth or not smooth; wrinkled; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing or not concealing radicle; notched at radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; white to yellow to tan (pale); inner face flat; glabrous around base of radicle. Embryonic axis oblique or right angled; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; bulbous or triangular; lobe tip straight; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule moderately to well developed; glabrous.

Distribution: Africa and eastern Asia.

Dolichos: *D. gululu* E.A.J. De Wildeman (*C–E*), *D. spp.* (*A–B*). *A*, Fruits ($\times 1.3$); *B*, seeds ($\times 4.5$); *C–D*, testa ($\times 50$, $\times 1000$); *E*, embryos ($\times 6$).



Genus: *Macrotyloma* (R. Wight & G.A.W. Arnott) B. Verdcourt

Phylogenetic Number: 10.65.

Tribe: Phaseoleae.

Subtribe: Phaseolinae.

Species Studied—Species in Genus: 8 spp.—24 spp.

Fruit a legume; unilocular; $1.1\text{--}6 \times 0.2\text{--}1.1 \times 0.2\text{--}0.5$ cm; with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight to curved (to slightly curved); not plicate; not twisted; asymmetrical or symmetrical; linear to oblong (narrowly), ovate (geocarpic fruit), falcate, or irregular (geocarpic fruit); when asymmetrical with 1 straight and 1 curved suture (in literature) or both sutures parallelly curved, unequally curved, or nearly straight; narrowest near middle, B-shaped; not inflated; compressed; with beak; declined to hooked; with solid beak the same color and texture as fruit; tapered at apex; apex aligned, oblique, or right-angled with longitudinal axis of fruit; tapered to short tapered to rounded at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; chartaceous to coriaceous; seed chambers externally visible or invisible; with the raised seed chambers not torulose. Fruit margin not constricted or constricted; slightly constricted along both margins or constricted only on 1 margin; without sulcus; plain or embellished; with ridges. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscent or indehiscent; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome or multicolored; mottled; brown or tan; with brown overlay; with mottling over seed chambers; glabrous or pubescent and indurate; with hairs appressed; with 1 type of pubescence; with pubescence golden to white; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; smooth or not smooth; with elevated or recessed features; veined or not veined; reticulately veined; not tuberculate; rugose to wrinkled; resinous punctate; not exfoliating; without cracks. Mesocarp thick; surface not veined; 1- or 2-layered; without balsamic vesicles; without fibers; solid; with solid layer over spongy layer; chartaceous. Endocarp dull to glossy; monochrome or mottled; tan to white; with mottling over seed chambers; with brown overlay; fibrous to smooth; subseptate

or nonseptate; with septa thin (tissue paper-like), flexible; with septa eglandular; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 1–8; length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus less than 0.5 mm long to measured; up to 1 mm long; of 1 length only; flattened to thick; straight. Aril dry; rim- and tongue-aril; entire; brown to cream.

Seed $4\text{--}12 \times 1.8\text{--}8 \times 0.6\text{--}3$ mm; not overgrown; not angular to angular (slightly); symmetrical or asymmetrical; elliptic, irregular, oblong, ovate, or reniform; compressed; with surface smooth; with or without visible radicle and cotyledon lobes; without external groove between radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; glossy to dull; not modified by a bloom; colored or clear; monochrome or mottled; with frequent or infrequent mottles; brown to black; with brown overlay; glabrous; smooth; chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum visible, partially concealed, or fully concealed; concealed by funicular remnant; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; $0.8\text{--}3.6$ mm long; with curved or straight outline; elliptic or linear; apical according to radicle tip but marginal according to seed length; recessed; not within corona, halo, or rim or within corona or corona and halo. Hilum corona color darker than testa. Hilum halo color darker than testa. Lens discernible; less than 0.5 mm or equal to or greater than 0.5 mm in length; $0.8\text{--}1.5$ mm long; with margins straight; linear; not in groove of raphe; confluent with hilum; recessed; same or similar color as testa; darker than testa; black or brown; within corona or not within corona, halo, or rim. Lens corona color darker than testa. Endosperm present or absent; trace; restricted to region of embryo; adnate to testa. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing radicle; notched at radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; yellow; inner face flat; glabrous around base of radicle. Embryonic axis right angled or oblique; oblique or perpendicular to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; bulbous; lobe tip curved; deflexed and parallel to cotyledon width or oblique to cotyledons; centered between cotyledons; less than 1/2 length of

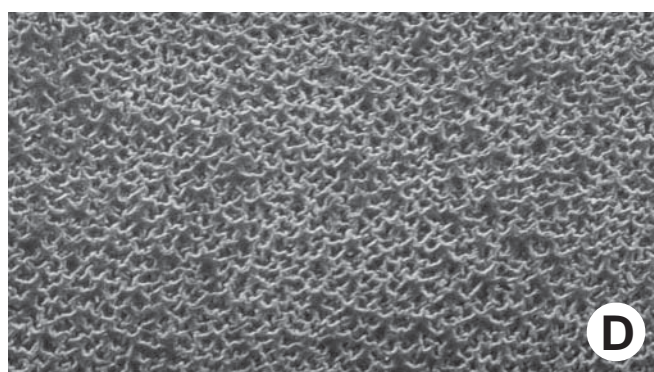
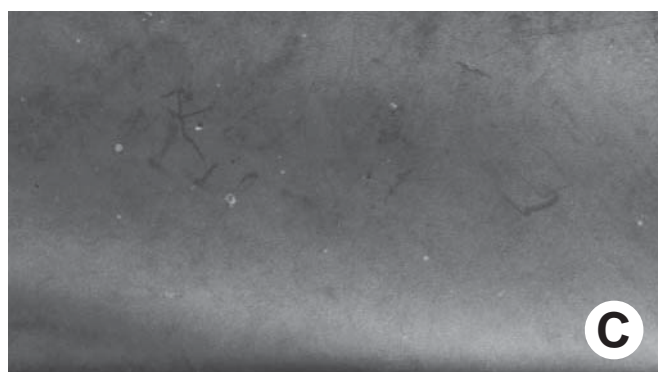
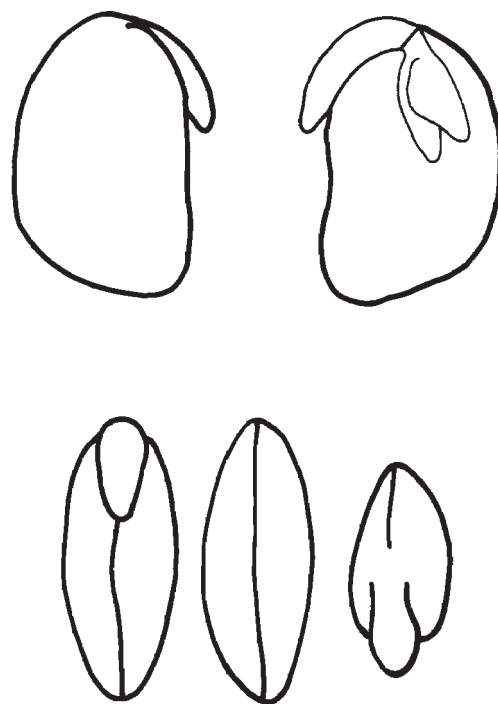
cotyledons. Plumule moderately to well developed;
glabrous.

Distribution: Africa and Asia.

Notes: *Macrotyloma* was monographed by Verdcourt
(1982).

Macrotyloma: *M. axillare* (E.H.F. Meyer) B. Verdcourt
(*C-E*), *M. spp.* (*A-B*). *A*, Fruits ($\times 1.2$); *B*, seeds
($\times 4.5$); *C-D*, testa ($\times 50$, $\times 1000$); *E*, embryos ($\times 6$).

0



Genus: *Vigna* C.G. Savi

Phylogenetic Number: 10.66.

Tribe: Phaseoleae.

Subtribe: Phaseolinae.

Species Studied—Species in Genus: 43 spp.—150 spp.

Fruit a legume; unilocular; $3\text{--}30\text{--}(40) \times 0.3\text{--}1.6 \times 0.25\text{--}1$ cm; with persistent or deciduous calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; symmetrical or asymmetrical; linear or falcate; when asymmetrical with both sutures nearly straight; inflated or not inflated; compressed to terete; with or without beak; straight; with solid beak the same color and texture as fruit; blunt, long tapered, tapered, or short tapered at apex; apex aligned with longitudinal axis of fruit; long tapered or tapered at base; base aligned or oblique with longitudinal axis of fruit; with the apex and base uniform in texture; chartaceous, coriaceous, or fleshy; seed chambers externally visible or invisible; with the raised seed chambers not torulose. Fruit margin not constricted or constricted; slightly constricted along both margins; without sulcus; plain or embellished; with ridges or thickened sutural areas. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome or multicolored; mottled; brown, green, or tan; with brown overlay; with surface texture uniform; glabrous, pubescent and indurate, or pubescent but soon deciduous; with hairs appressed; with 1 type of pubescence; puberulent, sericeous, or strigose; with pubescence brown to white; with pubescence uniformly distributed; with simple hairs; stiff; with hair bases swollen or plain; eglandular; without spines; smooth or not smooth; with recessed features; not veined; not tuberculate; minutely slitted obliquely; not exfoliating; without cracks. Mesocarp thin; surface not veined; 1- or 2-layered; without balsamic vesicles; without fibers; solid; with solid layer over solid layer; chartaceous or fleshy. Endocarp dull or glossy; opaque or translucent; monochrome; tan or white; smooth and pithy or smooth; without adhering pieces of testa; septate or subseptate; with septa thin (tissue paper-like), flexible; with septa eglandular; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 5–20; length parallel with or oblique to fruit length;

neither overlapping nor touching; in 1 series. Funiculus measured; 1–1.5 mm long; of 1 length only; flattened; straight or triangular (rarely). Aril fleshy or dry; when fleshy hippocrepiform rim-aril, 2-lipped rim-aril, or marginal hilar; crenate; covering less than 1/2 of seed; when dry rim-aril or rim- and tongue-aril; without tongue (or flap-like) on lips of 2-lipped rim-aril; cream.

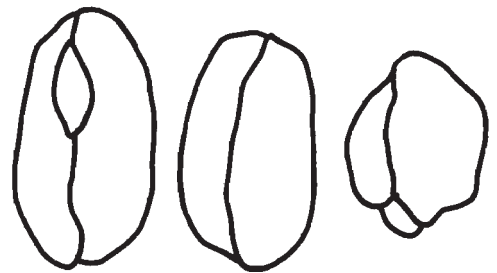
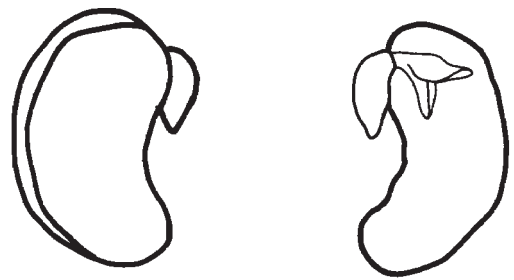
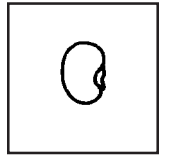
Seed $2\text{--}18 \times 1\text{--}13 \times 1\text{--}12$ mm; not overgrown; angular or not angular; symmetrical or asymmetrical; circular, elliptic, irregular, oblong, ovate, reniform, or rhombic (irregularly); terete or compressed; with surface smooth; with or without visible radicle and cotyledon lobes; without external groove between radicle and cotyledon lobes; with shallow hilar sinus or without hilar sinus; without umbo on seed faces; without medial ridge on each face. Cuticle not exfoliating; not inflated; not wrinkled. Testa without pieces of adhering epicarp; not adhering to endocarp; free from endocarp; dull; not modified or modified by a bloom; colored or clear (rarely); monochrome, bichrome, mottled, or streaked; with frequent or infrequent mottles; with infrequent streaks; brown, cream, red, tan, or white; with black or brown overlay; glabrous; smooth; coriaceous or chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe visible or not visible; from hilum through base of seed and up the other side; not bifurcating; color of testa; flush and raised. Hilum visible or fully concealed; concealed by aril or funicular remnant; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 1–4 mm long; with curved or straight outline; elliptic, oval, or linear; apical according to radicle tip but marginal according to seed length; recessed; within halo or rim or not within corona, halo, or rim. Hilum halo color lighter or darker than testa. Hilum rim color of, lighter than, or darker than testa. Lens discernible; equal to or greater than 0.5 mm in length; 1–2 mm long; with margins straight or curved; oblong or ovate; not in groove of raphe; confluent with hilum; mounded; same color as testa; brown or red; not within corona, halo, or rim. Endosperm present or absent; trace; not pluglike and not resembling tip of radicle; restricted to region of embryo; adnate to testa. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; with both folded or not folded; not sufficiently folded for inner face to touch itself; portions of inner folded face unequal; margin entire 180 degrees from base of radicle; similar at apex; partially concealing or not concealing radicle; notched at or split over radicle; with or without lobes; with lobes touching (auriculate) or not touching; with or without basal groin

formed by lobes; with the interface division terminating at base of radicle; with 1 margin recessed; recessed on same side as radicle; white; inner face flat or concave; glabrous around base of radicle. Embryonic axis oblique or right angled; oblique or perpendicular to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; bulbous, linear, or triangular; lobe tip straight or curved; oblique to cotyledons or deflexed and parallel to cotyledon length; centered between cotyledons; less than 1/2 length of cotyledons. Plumule moderately or well developed; glabrous.

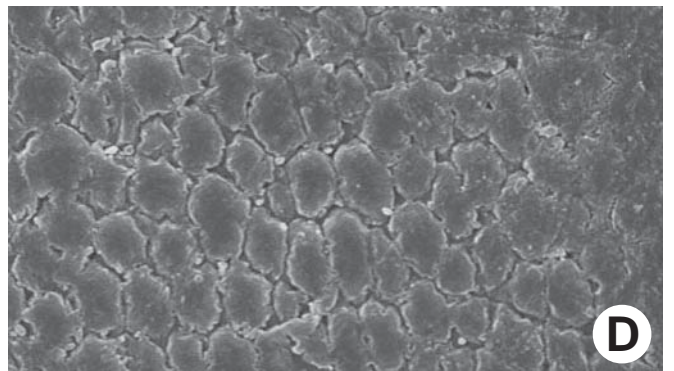
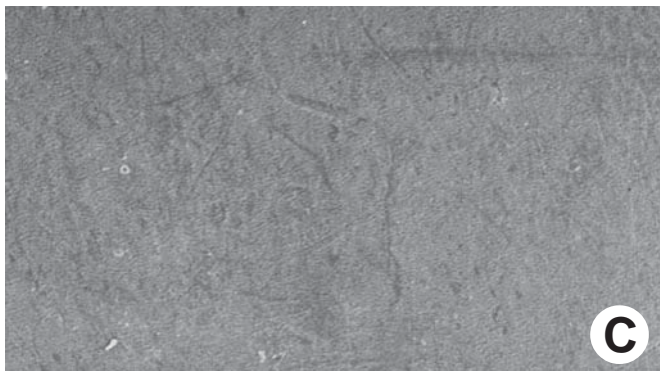
Distribution: Pantropics and widely cultivated.

Notes: Niyomdham (1992) transferred *Vigna pilosa* (J.T. Klein ex C.L. von Willdenow) J.G. Baker to the genus *Dolichovigna* B. Hayata. He considered the species to be intermediate between *Vigna* and *Dolichos* (10.64) and better placed in its own monotypic genus. We have left it in *Vigna*. Polhill (1994b) accepted *Wajira* M. Thulin (10.67) as a genus, but we have maintained it as a synonym of *Vigna*. Eight species or more of *Vigna* are cultivated, especially in the Old World (Duke 1981, Maesen and Somaatmadja 1989). The dried seeds of all cultivated species and the young pods of some species are used as human food, and some species are used as forage.

Vigna: *V. unguiculata* (C. Linnaeus) G.W. Walpers subsp. *unguiculata* (C-E), *V. spp.* (A-B). A, Fruits ($\times 1$); B, seeds ($\times 2.5$); C-D, testa ($\times 50$, $\times 1000$); E, embryos ($\times 3$).



E



Genus: *Ramirezella* J.N. Rose

Phylogenetic Number: 10.66A.

Tribe: Phaseoleae.

Subtribe: Phaseolinae.

Species Studied—Species in Genus: 2 spp.—7 spp.

Fruit a legume; unilocular; $10.5\text{--}16 \times \text{ca. } 1.3 \times 0.3\text{--}0.5$ cm; with deciduous calyx; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; symmetrical; narrowly oblong; not inflated; flattened; with beak (narrowly triangular, 17×3 mm, easily broken off); straight; with solid beak the same color and texture as fruit; tapered at apex; apex aligned with longitudinal axis of fruit; long tapered or tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; chartaceous; seed chambers externally invisible. Fruit margin not constricted; with sulcus (shallow); plain. Fruit wings absent. Fruit substipitate. Fruit with all layers dehiscent; splitting along sutures. Dehiscence of valves along both sutures; apical and down (assumed); active; with valves twisting. Replum invisible. Epicarp dull; monochrome; tan to greenish tan; with surface texture uniform; glabrous; eglandular; without spines; not smooth; with elevated or recessed features; not veined or veined (faintly); reticulately veined; not tuberculate; minutely slitted obliquely; not exfoliating; without cracks. Mesocarp thin; surface not veined; 2-layered; without balsamic vesicles; without fibers; with solid layer over solid layer; chartaceous. Endocarp dull or glossy (next to seeds); translucent or opaque (next to seeds); monochrome; white or tan; pithy, spongy and smooth (next to seeds), or smooth; without adhering pieces of testa; septate or subseptate; with septa thin (tissue paper-like), flexible; with septa eglandular; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 5–10; length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; 2–3.6 mm long; of 1 length only; flattened; triangular. Aril dry; tongue-aril; entire; covering less than 1/2 of seed; cream.

Seed $5.5\text{--}9.5 \times 3\text{--}9 \times 2.5\text{--}4.5$ mm; not overgrown; not angular; symmetrical; circular or elliptic; compressed or flattened (rarely); with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus;

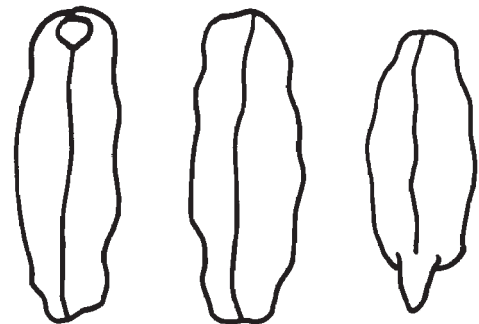
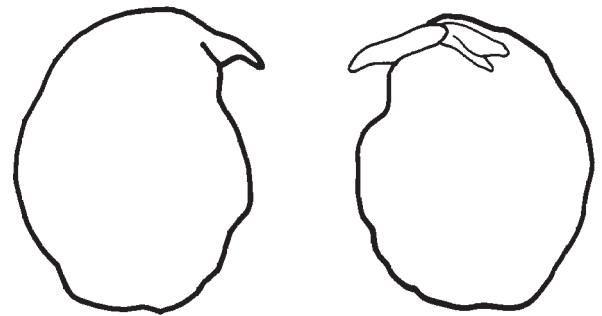
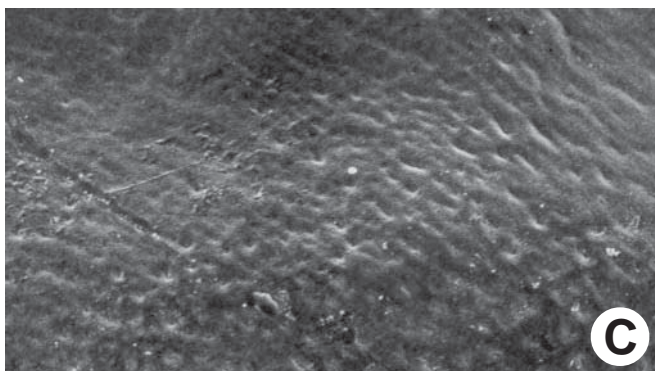
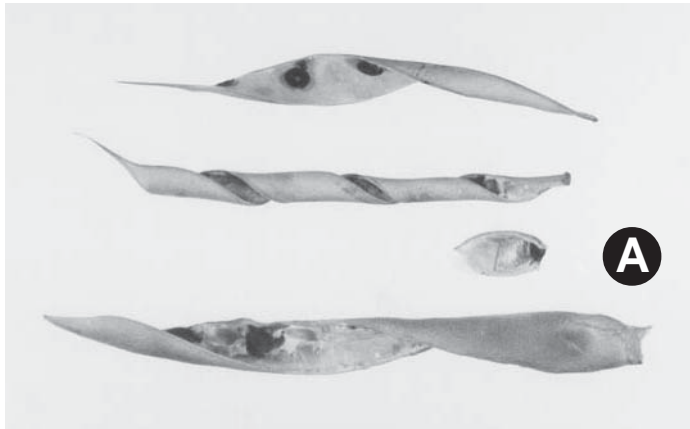
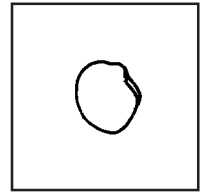
without umbo on seed faces; without medial ridge on each face. Cuticle not exfoliating; not inflated; not wrinkled. Testa without pieces of adhering epicarp; not adhering to endocarp; dull or glossy; not modified by a bloom; colored; mottled and streaked or monochrome (rarely); with frequent streaks; dark or light brown; with dark or light brown or brown and tan overlay; glabrous; not smooth or smooth; with elevated features; wrinkled; chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum fully concealed; concealed by funicular remnant; with faboid split; with the lips of the faboid split lighter colored than the rest of the hilum and therefore conspicuous; larger than punctiform; 2–3 mm long; with straight or curved outline; narrowly oval or linear; apical according to radicle tip but marginal according to seed length; recessed; within rim (sometimes weakly developed). Hilum rim color of testa. Lens discernible; equal to or greater than 0.5 mm in length; 0.6–1.3 mm long; with margins straight; linear; not in groove of raphe; confluent with hilum; recessed; same color as or dissimilar color from testa; darker than testa; dark brown; within rim. Lens rim color of or darker than testa. Endosperm absent. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; not concealing radicle; notched at radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; light brown; inner face flat; glabrous around base of radicle. Embryonic axis oblique; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; linear; lobe tip straight; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule well developed.

Distribution: From Mexico to Nicaragua.

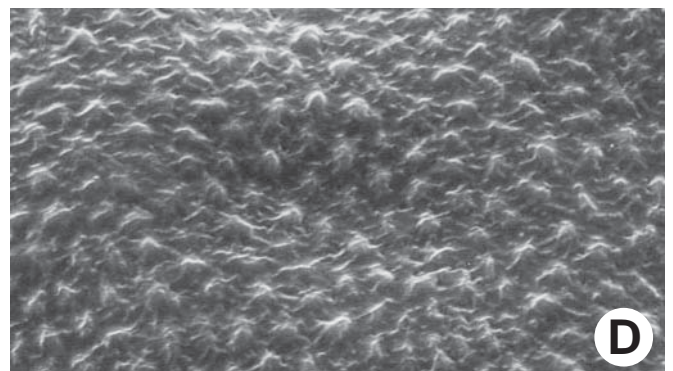
Notes: Lackey (1981b) noted that he preferred to merge *Ramirezella* into *Vigna* (10.66) and did so (Lackey 1983) without making the necessary new combinations. McVaugh (1987) also included *Ramirezella* in *Vigna* and made some of the needed combinations. Maréchal et al. (1978) maintained *Ramirezella* as a good genus separate from *Vigna*. Morphological (Ochoterena-Booth 1991, Ochoterena-Booth and Delgado Salinas 1994) and chloroplast DNA (Delgado Salinas et al. 1993) studies supported the proposition that

Ramirezella is a good genus. We agree with Maréchal et al. and not Lackey. The number of species and distribution are from Ochoterena-Booth and Delgado Salinas.

Ramirezella: *R. strobilophora* (B.L. Robinson) J.N. Rose
(*A*, *C–E*), *R. spp.* (*B*). *A*, Fruits ($\times 0.5$); *B*, seeds ($\times 6$);
C–D, testa ($\times 50$, $\times 1000$); *E*, embryos ($\times 5$).



E



Genus: *Oxyrhynchus* T.S. Brandegee

Phylogenetic Number: 10.68.

Tribe: Phaseoleae.

Subtribe: Phaseolinae.

Species Studied—Species in Genus: 3 spp.—4 spp.

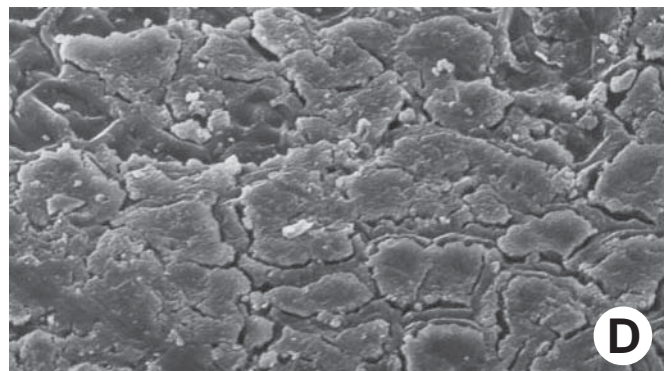
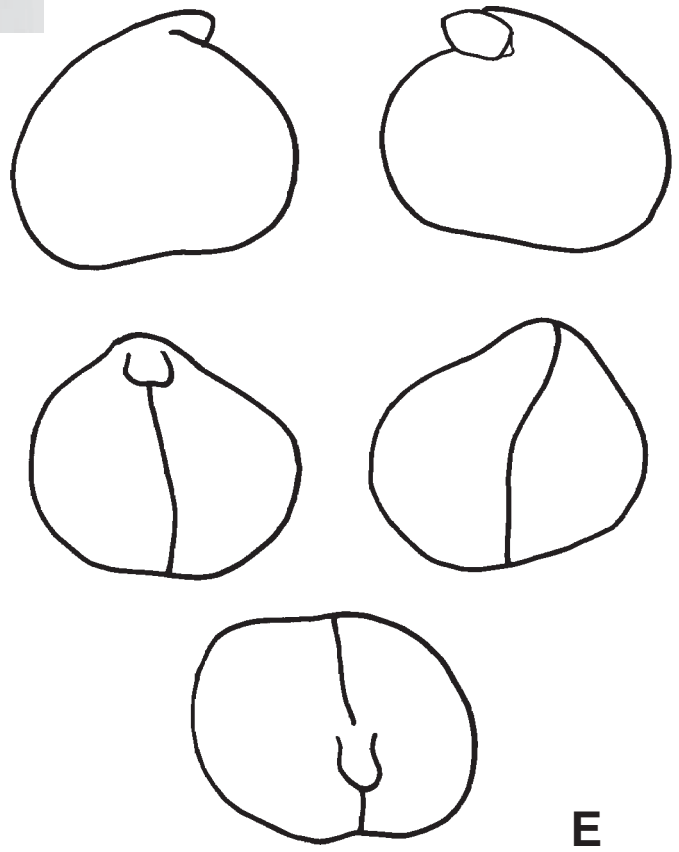
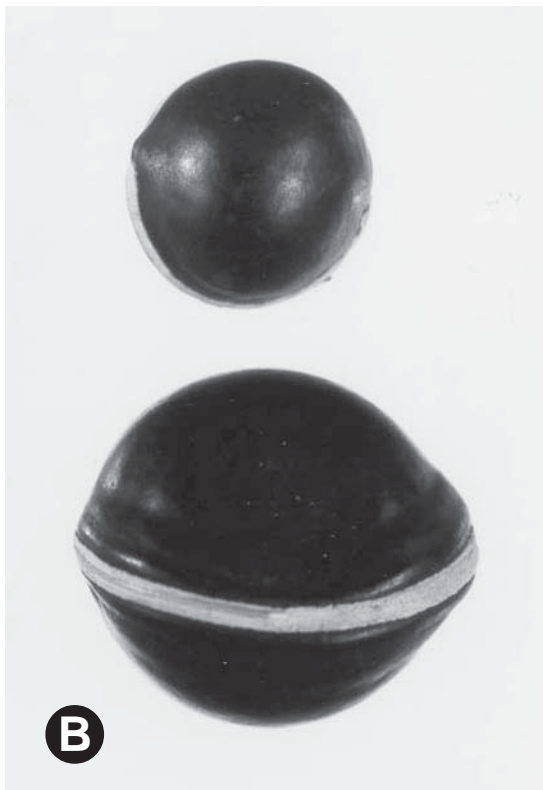
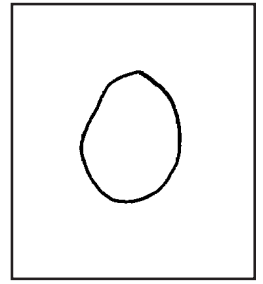
Fruit a legume; unilocular; $4\text{--}10 \times 1.8\text{--}3.6 \times 1.5\text{--}2.5$ cm; with deciduous calyx; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; asymmetrical or symmetrical; fusiform; when asymmetrical with 1 straight and 1 curved suture; widest near middle or D-shaped; not inflated; compressed or terete; with beak; straight or declined; with solid beak the same color and texture as fruit; short tapered at apex; apex aligned or oblique with longitudinal axis of fruit; tapered or rounded at base; base aligned or oblique with longitudinal axis of fruit; with the apex and base uniform in texture; chartaceous or coriaceous; seed chambers externally visible or invisible; with the raised seed chambers not torulose. Fruit margin not constricted; without sulcus; plain or embellished; with thickened sutural areas. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscent; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; multicolored; mottled; brown; with brown overlay; pubescent and indurate or pubescent but soon deciduous; with 1 type of pubescence; puberulent or sericeous; with pubescence golden; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; smooth; not veined; not tuberculate; not exfoliating; without cracks. Mesocarp thick; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; chartaceous. Endocarp dull; monochrome; white to tan; cobwebby, scurfy, smooth, and floury-filamentous; subseptate; with septa thin (tissue paper-like), flexible; with septa eglandular; chartaceous; exfoliating in part; remaining fused to mesocarp and epicarp; entire. Seeds 1–4; neither overlapping nor touching; in 1 series. Funiculus measured; at least 4 mm long; of 1 length only; thick; anvil-shaped. Aril present or absent; dry; 2-lipped rim-aril; entire; without tongue (or flap-like) on lips of 2-lipped rim-aril; cream.

Seed $13\text{--}20 \times 13\text{--}19 \times 11\text{--}18$ mm; not overgrown; not angular; symmetrical; circular or elliptic (broadly); terete; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; glossy to dull; not modified by a bloom; colored; monochrome; black to brown; glabrous; smooth or not smooth; with elevated features; wrinkled; coriaceous. Fracture lines present or absent; reticulate. Rim absent. Wings absent. Raphe not visible. Hilum visible, partially concealed, or fully concealed; concealed by funicular remnant or aril; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 13–25 mm long; with straight outline; linear; marginal according to radicle tip; flush; within rim. Hilum rim color of testa. Lens discernible; equal to or greater than 0.5 mm in length; 2–4 mm long; with margins straight; linear; not in groove of raphe; confluent with hilum; flush; same color as testa; brown; within rim. Lens rim color of testa. Endosperm absent. Cotyledons smooth or not smooth; wrinkled; both outer faces convex; both the same thickness; both more or less of equal length; with both folded or not folded; sufficiently folded for inner face to touch itself; portions of inner folded face unequal; margin entire or not entire 180 degrees from base of radicle; notched; similar at apex; partially concealing radicle; notched at radicle; without lobes; with the interface division terminating at base of radicle; with 1 margin recessed; recessed on same side as radicle; tan; inner face flat; glabrous around base of radicle. Embryonic axis oblique; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; bulbous; lobe tip straight; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Central America (3 spp.) and New Guinea (1 sp.).

Notes: Seed alignment relative to fruit length could not be determined for this genus because the available fruits all had the seeds detached from the funiculi.

Oxyrhynchus: *O. trinervis* (J.D. Smith) V.E. Rudd (*C–E*), *O.* spp. (*A–B*). *A*, Fruits ($\times 0.8$); *B*, seeds ($\times 3.1$); *C–D*, testa ($\times 50$, $\times 1000$); *E*, embryos ($\times 2$).



Genus: *Dolichopsis* E. Hassler

Phylogenetic Number: 10.69.

Tribe: Phaseoleae.

Subtribe: Phaseolinae.

Species Studied—Species in Genus: 1 sp.—2 spp.

Fruit a legume; unilocular; $2.5\text{--}3.5 \times 0.8\text{--}0.9$ cm; with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight or curved (slightly); not plicate; not twisted; asymmetrical; reniform; when asymmetrical with 1 straight and 1 curved suture or both sutures unequally curved; widest near middle or D-shaped; not inflated; compressed; with beak; straight; with solid beak the same color and texture as fruit; short tapered at apex; apex oblique with longitudinal axis of fruit; rounded at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous; seed chambers externally visible; with the raised seed chambers not torulose. Fruit margin not constricted; without sulcus; embellished; with thickened sutural areas. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome; brown to tan; pubescent and indurate; with hairs appressed; with 1 type of pubescence; with pubescence white; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; smooth; not veined; not tuberculate; not exfoliating; without cracks. Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; solid; chartaceous. Endocarp dull; monochrome; tan; smooth; septate; with septa thin (tissue paper-like), flexible; with septa eglandular; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 4–8; length transverse to fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; 2–3 mm long; of 1 length only; flattened; narrowly triangular. Aril dry; 2-lipped rim-aril; fimbriate; with tongues (or flap-like) on lips of 2-lipped rim-aril; with 1 tongue or flap on 1 lip of 2-lipped rim-aril; tan.

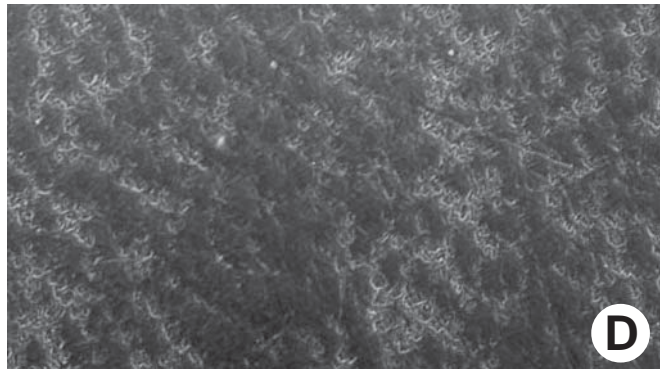
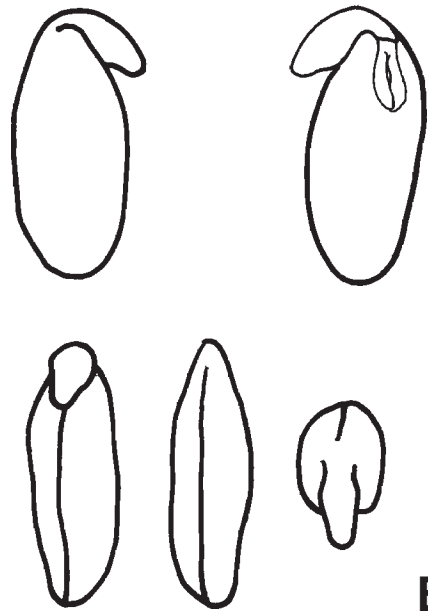
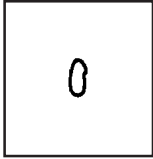
Seed $5.4\text{--}6.7 \times 2.5\text{--}3 \times 1.1\text{--}2.1$ mm; not overgrown; not angular; asymmetrical; irregularly elliptic; compressed; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on

seed faces. Testa not adhering to endocarp; dull; not modified by a bloom; colored; monochrome; dark brown; glabrous; smooth; coriaceous. Fracture lines absent. Rim absent. Wings absent. Raphe visible or not visible; from hilum to near base of seed and terminating; not bifurcating; darker than testa; black. Hilum partially concealed; concealed by aril; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 3.5–4.6 mm long; with straight outline; linear; marginal according to radicle tip; recessed; within rim. Hilum rim color of or darker than testa. Lens discernible; less than 0.5 mm in length; with margins straight; linear; not in groove of raphe; confluent with hilum; flush; same color as testa; brown; within rim. Lens rim color of or darker than testa. Endosperm trace; restricted to region of embryo; adnate to testa. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing radicle; notched at radicle; without lobes; with the interface division terminating at base of radicle; with 1 margin recessed; recessed on same side as radicle; yellow; inner face flat; glabrous around base of radicle. Embryonic axis oblique; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; linear; lobe tip curved; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule well developed; glabrous.

Distribution: South America.

Notes: Lackey (1981b) noted that “*Dolichos monticola* [C.F.P. von Martius ex G. Benth] is better placed in this genus.” Delgado Salinas and Lewis (1997) created the monotypic genus *Oryxis* A. Delgado Salinas & G.P. Lewis for *Dolichopsis monticola* (C.F.P. von Martius ex G. Benth) J.A. Lackey ex G.P. Lewis. We are not recognizing the new genus pending an expression on its status by the general botanical community.

Dolichopsis: *D. paraguariensis* E. Hassler (A–E). A, Fruits ($\times 4.3$); B, seeds ($\times 10$); C–D, testa ($\times 50$, $\times 1000$); E, embryos ($\times 8$).



Genus: *Strophostyles* S. Elliott

Phylogenetic Number: 10.70.

Tribe: Phaseoleae.

Subtribe: Phaseolinae.

Species Studied—Species in Genus: 3 spp.—3 spp.

Fruit a legume; unilocular; $4-7 \times 0.5-0.8 \times 0.3-0.5$ cm; with persistent or deciduous calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight to curved (slightly); not plicate; not twisted; symmetrical; linear; not inflated; compressed to terete; without beak; long tapered to tapered at apex; apex aligned to oblique (slightly) with longitudinal axis of fruit; tapered to rounded at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; chartaceous to coriaceous; seed chambers externally invisible or visible (slightly); with the raised seed chambers not torulose. Fruit margin not constricted or constricted; slightly constricted along both margins; without sulcus; plain. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome; brown; glabrate or pubescent and indurate; with hairs (sparse) appressed; with 1 type of pubescence; with pubescence golden; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; smooth or not smooth; with elevated features; not veined; not tuberculate; wrinkled; not exfoliating; without cracks. Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; subcoriaceous to chartaceous. Endocarp dull; monochrome; white; cobwebby to scurfy to floury-filamentous; subseptate; osseous; exfoliating in part; remaining fused to mesocarp and epicarp; entire. Seeds 3–8; length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus less than 0.5 mm long; of 1 length only; flattened; straight. Aril dry; tongue-aril or 2-lipped rim-aril (narrow); entire; with tongues (or flap-like) on lips of 2-lipped rim-aril; with 1 tongue or flap on 1 lip of 2-lipped rim-aril; cream.

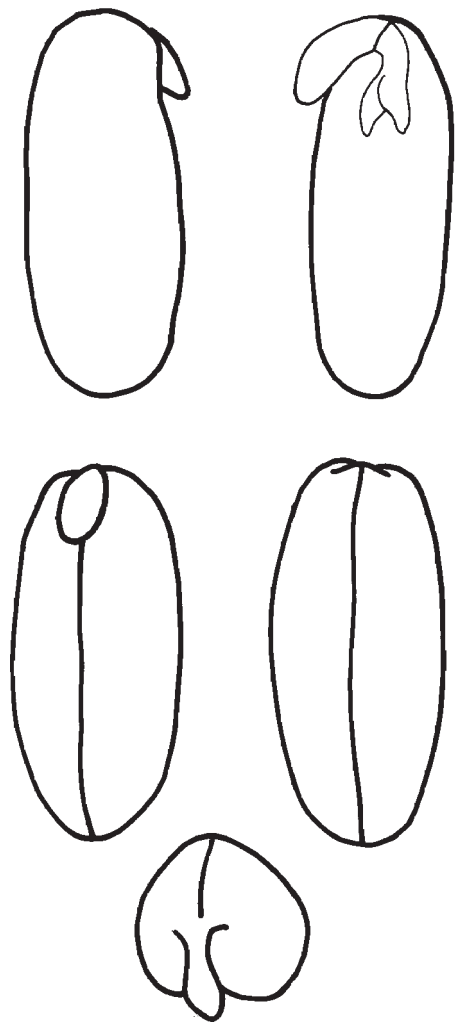
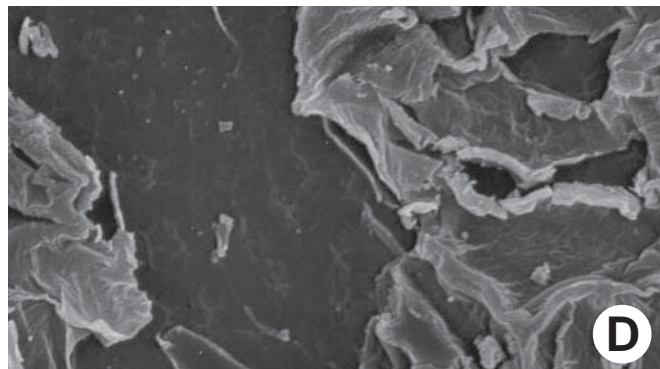
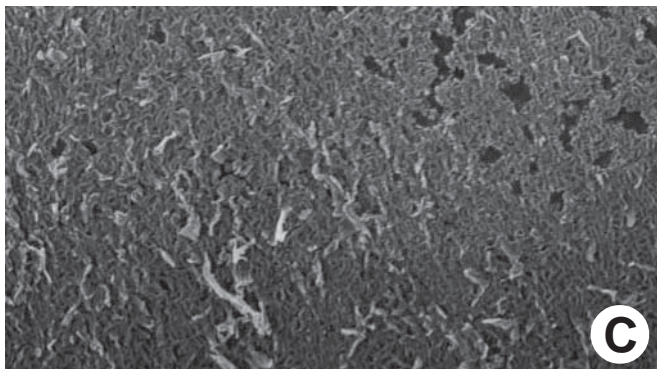
Seed $7.2-10.5 \times 3.5-5.5 \times 3.7-5.2$ mm; not overgrown; angular to not angular; symmetrical; oblong to rectangular; terete; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus;

without umbo on seed faces. Testa not adhering or partially adhering to endocarp; glossy to dull; not modified by a bloom; colored; monochrome or mottled; with frequent mottles; dark brown; with brown overlay; glabrous; smooth; coriaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum fully concealed; concealed by funicular remnant; without faboid split; larger than punctiform; 4.2–6.3 mm long; with straight outline; linear; apical according to radicle tip but marginal according to seed length; raised; within rim. Hilum rim color of or darker than testa. Lens discernible; equal to or greater than 0.5 mm in length; 0.8–1 mm long; with margins straight or curved; linear or circular; not in groove of raphe; confluent with hilum; mounded; same or similar color as testa; lighter than testa; brown; within rim or not within corona, halo, or rim. Lens rim color of testa. Endosperm absent. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing radicle; notched at radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; white; inner face flat; glabrous around base of radicle. Embryonic axis oblique; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; linear; lobe tip curved; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule well developed; glabrous.

Distribution: North America and Mexico.

Notes: Yanful and Maun (1996) found fruits of *Strophostyles helvula* with up to eight seeds. Fragments of endocarp adhere to the testa, sometimes giving the false impression that it is pubescent.

Strophostyles: *S. helvula* (C. Linnaeus) S. Elliott (*C–E*), *S.* spp. (*A–B*). *A*, Fruits ($\times 1.2$); *B*, seeds ($\times 6.5$); *C–D*, testa ($\times 50$, $\times 1000$); *E*, embryos ($\times 5$).



E

Genus: *Macroptilium* (G. Benth) I. Urban

Phylogenetic Number: 10.71.

Tribe: Phaseoleae.

Subtribe: Phaseolinae.

Species Studied—Species in Genus: 9 spp.—20 spp.

Fruit a legume; unilocular; $1.5\text{--}13 \times 0.3\text{--}0.6 \times 0.3\text{--}0.5$ cm; with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight or curved (slightly); not plicate; not twisted; asymmetrical or symmetrical; linear or falcate; when asymmetrical with both sutures parallelly curved; not inflated; compressed to terete; without beak; long tapered to tapered at apex; apex aligned or oblique with longitudinal axis of fruit; tapered to short tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; chartaceous to coriaceous; seed chambers externally invisible. Fruit margin not constricted; without sulcus; plain or embellished; with thickened (slightly) sutural areas. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome; brown, green, or tan; pubescent and indurate; with hairs erect or appressed; with 1 or 2 types of pubescence; pilose, puberulent, or villous; with pubescence golden, gray-brown, or white; with long and short white hairs intermixed; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; smooth; not veined; not tuberculate; not exfoliating; without cracks. Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; solid; coriaceous to chartaceous. Endocarp dull; monochrome; white; cobwebby to fibrous; septate; with septa thin (tissue paper-like), flexible; with septa eglandular; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 1–27; length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; 0.5 mm long; of 1 length only; flattened; triangular. Aril dry or fleshy (rarely); when fleshy hippocrepiform rim-aril; crenate; covering 1/2 to nearly all of seed; when dry rim-aril or 2-lipped rim-aril; entire; covering less than 1/2 of seed; without tongue (or flap-like) on lips of 2-lipped rim-aril; cream to white.

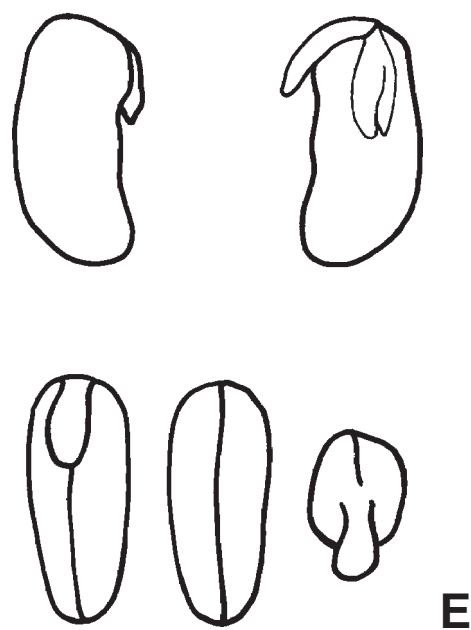
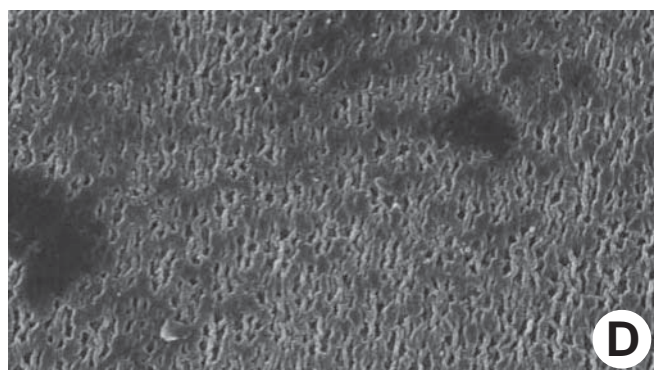
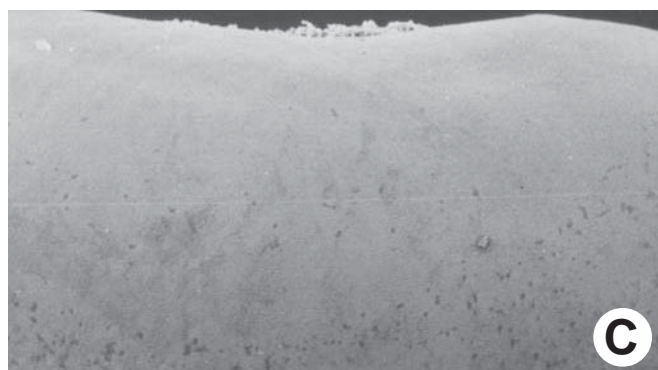
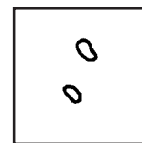
Seed $3\text{--}7 \times 2\text{--}4.5 \times 1.5\text{--}4$ mm; not overgrown; angular or not angular; symmetrical or asymmetrical; irregular, oblong, ovate, or reniform; terete to compressed; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; glossy to dull; not modified or modified by a bloom; colored; monochrome or mottled; with frequent mottles; brown to black; with dark brown to black overlay; glabrous; smooth; chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum visible or partially concealed; concealed by aril; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 1–4.2 mm long; with curved outline; elliptic or oval; apical according to radicle tip but marginal according to seed length; recessed; within corona or corona and halo. Hilum corona color darker than testa. Hilum halo color lighter than testa. Lens discernible; less than 0.5 mm or equal to or greater than 0.5 mm in length; 0.5–1 mm long; with margins straight; linear; not in groove of raphe; confluent with hilum; mounded; similar color as testa; darker than testa; brown; within rim or not within corona, halo, or rim. Lens rim color darker than testa. Endosperm absent. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing radicle; notched at radicle; without lobes; with the interface division terminating at base of radicle; without or with 1 margin recessed; recessed on same side as radicle; yellowish white to white; inner face flat; glabrous around base of radicle. Embryonic axis oblique; perpendicular to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; linear; lobe tip curved; with 180-degree turn to oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule moderately or well developed; glabrous.

Distribution: Neotropics and neosubtropics; widely cultivated in tropics (*M. atropurpureum*).

Notes: *Macroptilium* was treated for Brazil by Barbosa-Ferreiro (1987). Underground fruits and seeds of *M. gracile* (E.F. Poeppig ex G. Benth) I. Urban, *M. heterophyllum* (C.L. von Willdenow) R. Maréchal & J.C. Baudet, *M. panduratum* (C.F.P. von Martius ex G. Benth) R. Maréchal & J.C. Baudet, and *M. pedatum* (J.N. Rose) R. Maréchal & J.C. Baudet were not

available for study. *Macroptilium atropurpureum* (A.-P. de Candolle) I. Urban 'Sirato' is one of the most important tropical pasture legumes (Duke 1981); it is very drought resistant.

Macroptilium: *M. lathyroides* (C. Linnaeus) I. Urban (*C–E*),
M. spp. (*A–B*). *A*, Fruits ($\times 1.2$); *B*, seeds ($\times 6.7$);
C–D, testa ($\times 50$, $\times 1000$); *E*, embryos ($\times 8$).



Genus: *Phaseolus* C. Linnaeus

Phylogenetic Number: 10.72.

Tribe: Phaseoleae.

Subtribe: Phaseolinae.

Species Studied—Species in Genus: 34 spp.—36 spp.

Fruit a legume; unilocular; $1-18 \times 0.2-2 \times 0.2-1.1$ cm; with persistent or deciduous calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight or curved (or slightly curved); not plicate; not twisted; asymmetrical or symmetrical; linear, falcate, or irregular; when asymmetrical with both sutures parallelly curved, both sutures unequally curved, or 1 straight and 1 curved suture; widest near middle or D-shaped; not inflated; flattened to compressed to terete; without or with beak; declined or hooked; with solid beak the same color and texture as fruit; long tapered to tapered to short tapered at apex; apex aligned or oblique with longitudinal axis of fruit; tapered or short tapered at base; base aligned or oblique with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous to chartaceous; seed chambers externally invisible. Fruit margin not constricted; without sulcus; plain or embellished; with thickened sutural areas. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscent; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome or multicolored; mottled; yellow to tan to brown to black, green, or red; with brown overlay; with mottling over seed chambers; glabrous, glabrate, or pubescent and indurate; with 1 or 2 types of pubescence; puberulent, pilose, strigose, or pilose and puberulent; with pubescence golden or white; with pubescence uniformly distributed; with simple hairs; pliable or pliable and stiff; with hair bases plain or swollen; glandular or eglandular; with glandular dots; without spines; smooth or not smooth; with elevated features; not veined; not tuberculate; dotted, wrinkled, or wrinkled and dotted; not exfoliating; without cracks. Mesocarp present or absent; thin; surface not veined; 1-layered; without balsamic vesicles; solid; coriaceous to chartaceous. Endocarp dull; monochrome; tan or white; smooth; septate or subseptate; with septa thin (tissue paper-like), flexible; with septa eglandular; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; remaining fused to epicarp; entire. Seeds $1-12(-20)$; length

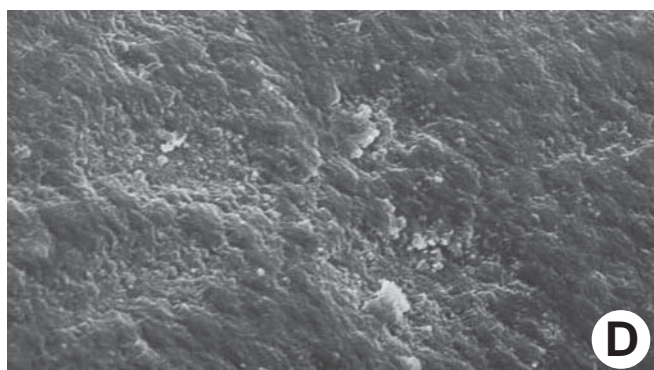
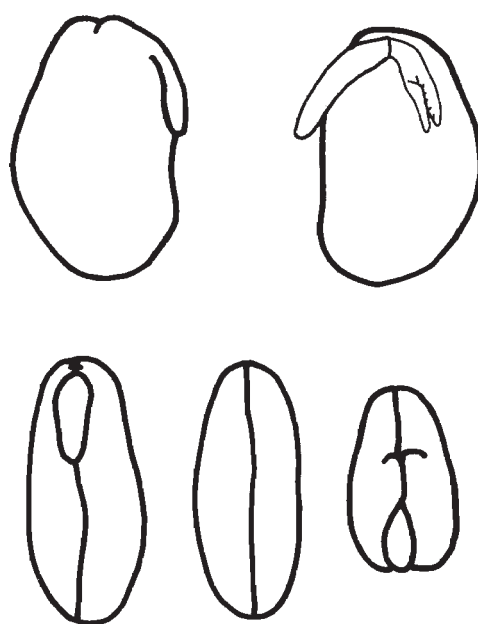
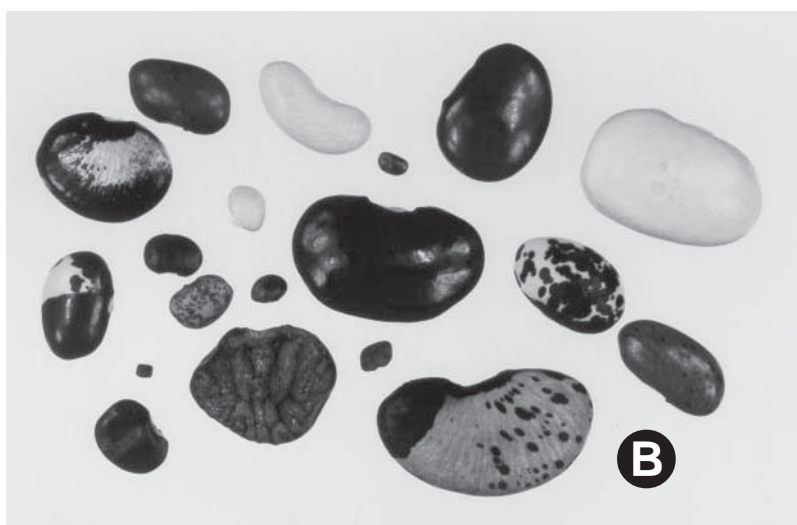
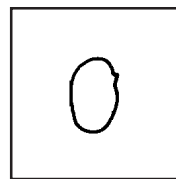
parallel with or transverse (rarely) to fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; $0.5-1$ mm long; of 1 length only; flattened; straight or triangular. Aril present or absent; dry; tongue-aril; fimbriate; cream.

Seed $1.5-33 \times 1.5-20 \times 1-12$ mm; not overgrown; not angular or angular; symmetrical or asymmetrical; elliptic, reniform, trapezoid, irregular, oblong, or ovate; compressed, flattened, terete, or quadrangular; with surface smooth; without visible radicle and cotyledon lobes; with shallow hilar sinus or without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; glossy to dull; not modified by a bloom; colored or clear; monochrome, mottled, or bichrome; with frequent mottles; greenish brown or reddish brown to brown, black, white, red, or brown and white; with brown, brown and tan, or black overlay; glabrous; smooth or not smooth; with elevated features; rugose or wrinkled; chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe visible or not visible; from hilum to near base of seed and terminating or from hilum through base of seed and up the other side; not bifurcating; color of testa; raised or recessed. Hilum fully concealed; concealed by funicular remnant; with faboid split; larger than punctiform; $0.3-6$ mm long; with curved outline; narrowly elliptic to circular or oval (narrowly); apical according to radicle tip but marginal according to seed length; recessed, flush, or raised; within rim. Hilum rim color of or darker than testa. Lens discernible; equal to or greater than 0.5 mm in length; $0.5-2$ mm long; with margins straight or curved; triangular or circular; not in groove of raphe; confluent with hilum; mounded; same or similar color as testa; lighter or darker than testa; black, brown, or tan; within rim or not within corona, halo, or rim. Lens rim color of testa. Endosperm absent. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire or not entire 180 degrees from base of radicle; wavy; similar at apex; partially concealing radicle; notched at radicle; without lobes; with the interface division terminating at base of radicle; without or with 1 margin recessed; recessed on same side as radicle; white, yellow, or tan; inner face slightly concave or flat; glabrous around base of radicle. Embryonic axis oblique, parallel, or right angled; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; slightly bulbous or linear; lobe tip slightly curved or straight; oblique to cotyledons; centered between cotyledons; less than $1/2$ length of cotyledons. Plumule moderately to well developed; glabrous.

Distribution: New World and widely cultivated.

Notes: Delgado Salinas (1985) monographed North and Central American *Phaseolus*, and his species count is used rather than that of Lackey (1981b). Delgado Salinas et al. (1988) described and illustrated the “dehiscence slit” found in *P. vulgaris* C. Linnaeus and *P. leptostachyus* G. Benth. The dehiscence slit is a short opening in the fruit suture close to the pedicel prior to full dehiscence. Seeds cannot pass through it, but females of *Zabrotes subfasciatus*, a bruchid, pass through the slit to oviposit on the first seed. Females of *Acanthoscelides obtectus* and *A. obvelatus*, also bruchids, oviposit directly through the dehiscence slit. Four species of large-seeded *Phaseolus* are commonly cultivated as human food (Duke 1981, Schery 1972): *P. acutifolius*, tepary bean; *P. coccineus* C. Linnaeus, scarlet runner bean; *P. lunatus* C. Linnaeus, lima bean; and *P. vulgaris*, bean or common bean. *Phaseolus vulgaris* is the most frequently and widely cultivated of the four, having a protein content of 17–37 percent and an average content of about 25 percent (Duke 1981, Schery 1972). The seed coat contains 4.8 percent of the protein in the seed (Werker 1997).

Phaseolus: *P. acutifolius* A. Gray (*C–E*), *P. spp.* (*A–B*). *A*, Fruits ($\times 0.7$); *B*, seeds ($\times 1$); *C–D*, testa ($\times 50$, $\times 1000$); *E*, embryos ($\times 3$).



Genus: *Mysanthus* G.P. Lewis & A. Delgado Salinas

Phylogenetic Number: 10.72A.

Tribe: Phaseoleae.

Subtribe: Phaseolinae.

Species Studied—Species in Genus: 1 sp.—1 sp.

Fruit a legume; unilocular; 4.8–6.5 (from literature) \times 0.8–1 (–1.4) (from literature) \times ca. 0.5 cm; without orifice formed by curving of fruit or fruit segments; slightly curved; not plicate; not twisted; asymmetrical; falcate; when asymmetrical with both sutures parallelly curved; not inflated; compressed; without beak; tapered at apex; apex aligned with longitudinal axis of fruit; rounded at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous; seed chambers externally invisible. Fruit margin not constricted; without sulcus; embellished; with thickened sutural areas. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome; green to tan (yellowish); glabrate to pubescent and indurate; with 1 type of pubescence; puberulent; with pubescence white; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; not smooth; slightly, reticulately veined; not tuberculate; not exfoliating; without cracks. Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; solid; coriaceous. Endocarp dull; monochrome; white; smooth; septate; with septa thin (tissue paper-like), flexible; with septa eglandular; chartaceous; exfoliating in part; remaining fused to mesocarp and epicarp; entire. Seeds 5–8 (from literature); length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; ca. 1 mm long; of 1 length only; flattened; straight. Aril dry; rim- and tongue-aril; entire; tan.

Seed 5–7 \times 3.5–5 \times 2–2.5 mm; not overgrown; not angular; symmetrical; elliptic to reniform; compressed; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; glossy to dull; not modified by a bloom; colored; mottled; with frequent mottles; reddish brown to tan; with black overlay; glabrous; smooth; chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible.

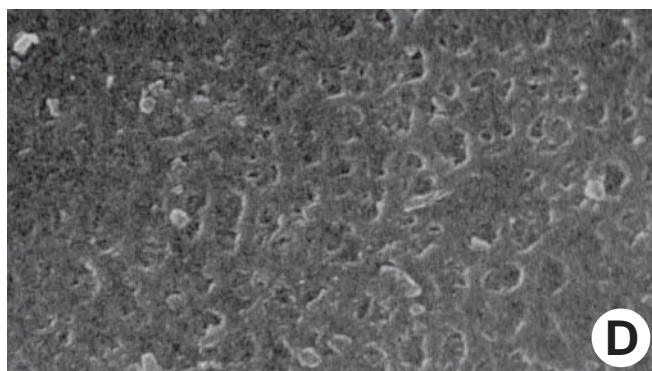
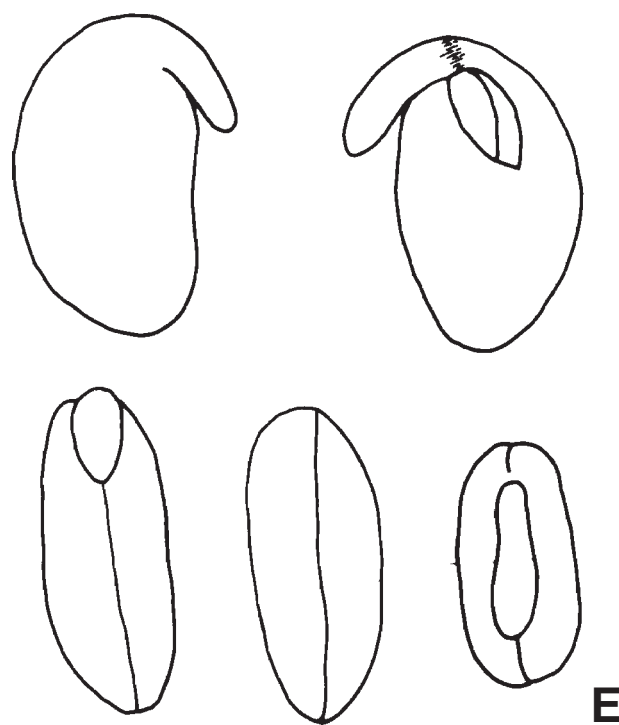
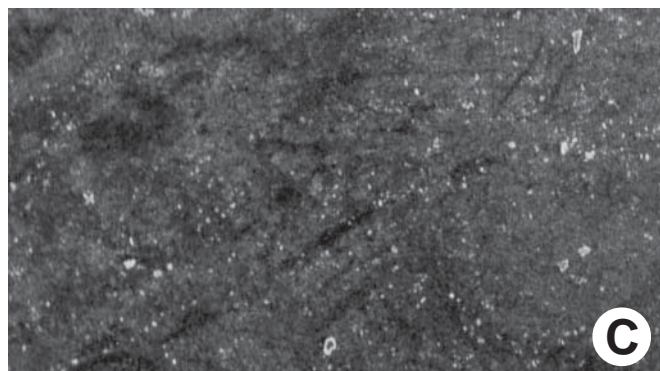
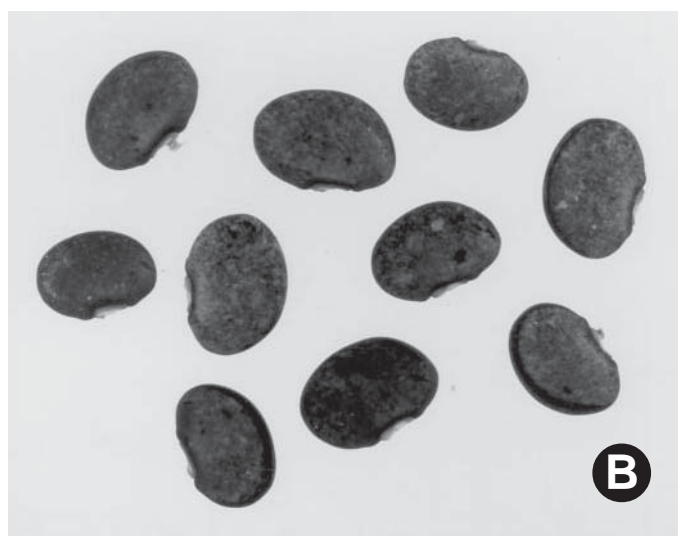
Hilum partially concealed; concealed by aril; without faboid split; larger than punctiform; 1.5–2 mm long; with curved outline; oval; apical according to radicle tip but marginal according to seed length; flush; within rim. Hilum rim color of testa. Lens discernible; equal to or greater than 0.5 mm in length; 0.7–1 mm long; with margins straight; linear; not in groove of raphe; confluent with hilum; mounded; similar color as testa; darker than testa; brown or tan; within rim. Lens rim color of testa. Endosperm absent. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing radicle; notched at radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; white; inner face flat; glabrous around base of radicle. Embryonic axis right angled; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; linear; lobe tip curved; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule well developed; glabrous.

Distribution: Brazil in the states of Bahia and São Paulo.

Notes: *Mysanthus* was segregated from *Phaseolus* (10.72) by Lewis and Delgado Salinas (1994). Its position in subtribe Phaseolinae is uncertain (Lewis and Delgado Salinas 1994). Data from the single sample studied was supplemented from their description.

Mysanthus: *M. uleanus* (H.A.T. Harms) G.P. Lewis & A.O. Delgado Salinas var. *uleanus* (A–E). A, Fruits (\times 1.6); B, seeds (\times 4.4); C–D, testa (\times 50, \times 1000); E, embryos (\times 7).

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Genus: *Cajanus* A.-P. de Candolle

Phylogenetic Number: 10.73.

Tribe: Phaseoleae.

Subtribe: Cajaninae.

Species Studied—Species in Genus: 13 spp.—31 spp.

Fruit a legume; unilocular; $1.3\text{--}9.5 \times 0.6\text{--}1.4 \times$ up to 0.25 cm; with persistent or deciduous calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight or curved (slightly); not plicate; not twisted; asymmetrical; falcate, linear, moniliform, or irregular; when asymmetrical with both sutures parallelly curved, unequally curved, or nearly straight; not inflated; compressed; without or with beak; declined; with solid beak the same color and texture as fruit; tapered or short tapered at apex; apex aligned to oblique with longitudinal axis of fruit; tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous; seed chambers externally visible; with the raised seed chambers not torulose. Fruit margin not constricted; without sulcus; plain. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscent or indehiscent; splitting along sutures. Dehiscence of valves along both sutures; assumed apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome or multicolored; mottled; brown; with brown (light) overlay; with mottling over seed chambers; pubescent and indurate; with hairs appressed; with 2 or 3 types of pubescence; with pubescence golden; with pubescence uniformly distributed; with simple and glandular hairs or simple, glandular, and complex hairs; with bristle-like hairs; stiff; with hair bases swollen and plain; straight; straight at apex; glandular; with glandular dots or dots and hairs; without spines; smooth; not tuberculate; not exfoliating; without cracks. Mesocarp thin; 1-layered; without balsamic vesicles; solid; coriaceous. Endocarp dull; monochrome; white, tan, or brown; smooth; septate; with septa thin (tissue paper-like), flexible; with septa eglandular; chartaceous; exfoliating in part; remaining fused to mesocarp and epicarp; entire. Seeds 2–9; length parallel with or transverse to fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; 1 mm long; of 1 length only; flattened; hooked. Aril present or absent; fleshy (if fleshy, also hard) or dry; when fleshy 2-lipped rim-aril or hippocrepiform rim-aril; entire;

covering less than $1/2$ of seed; when dry 2-lipped rim-aril or hippocrepiform rim-aril; entire; covering less than $1/2$ of seed; without or with tongues (or flap-like) on lips of 2-lipped rim-aril; with 2 tongues or flaps, 1 on each lip of 2-lipped rim-aril or 1 tongue or flap on 1 lip of 2-lipped rim-aril; ivory, cream, or tan.

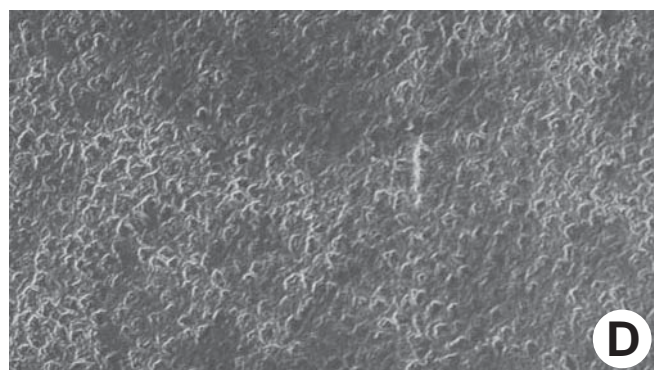
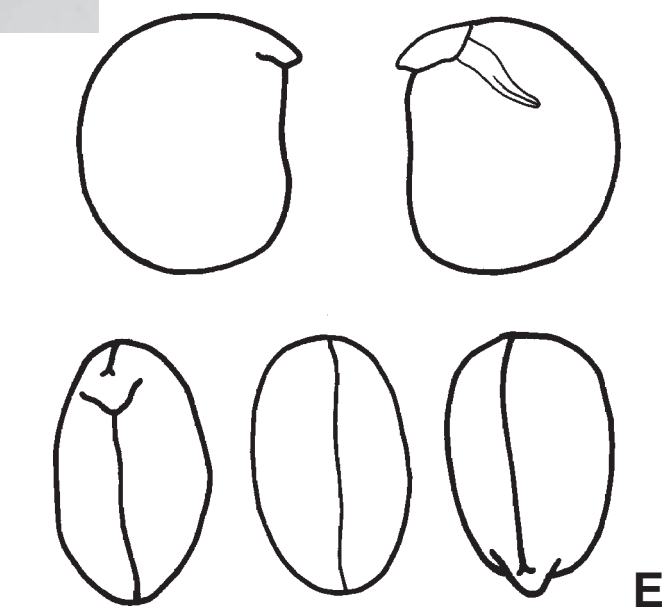
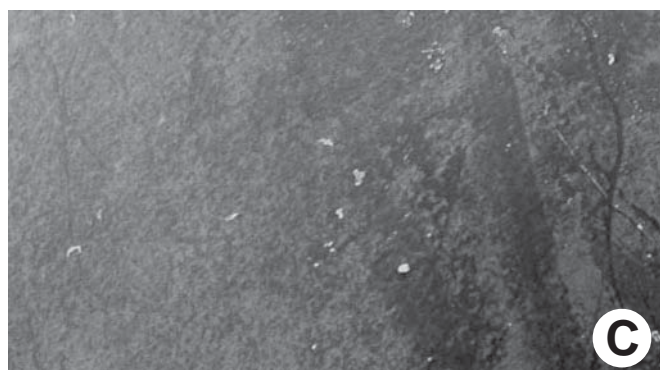
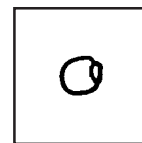
Seed $3.4\text{--}9 \times 2.8\text{--}8.5 \times 1.7\text{--}6.3$ mm; not overgrown; not angular; symmetrical; oblong to circular to reniform; terete; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; dull or glossy; not modified by a bloom; colored; monochrome, bichrome, mottled, or streaked (in literature); with frequent mottles; reddish brown, cream, black (nearly), gray, white, orange, or purple; with brown overlay; glabrous; smooth or not smooth; with recessed features; pitted with small separate pits; coriaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum partially concealed, fully concealed, or visible; concealed by aril; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; up to 4.5 mm long; with curved outline; elliptic; apical according to radicle tip but marginal according to seed length; flush or raised; within rim. Hilum rim color darker than testa. Lens discernible; equal to or greater than 0.5 mm in length; up to 1 mm long; with margins straight; linear; not in groove of raphe; confluent with hilum; flush; dissimilar color from testa; darker than testa; dark brown; not within corona, halo, or rim. Endosperm absent. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing radicle; notched at radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; white to tan; inner face flat; glabrous around base of radicle. Embryonic axis oblique; oblique, parallel, or perpendicular to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; linear; lobe tip straight; deflexed and parallel to cotyledon width or oblique to cotyledons; centered between cotyledons; less than $1/2$ length of cotyledons. Plumule moderately to well developed; glabrous.

Distribution: Africa throughout Asia to Australia and Oceania and cultivated (1 species).

Notes: Also included in this genus is *Atylosia* R. Wright & G.A.W. Arnott, which Van der Maesen (1986) placed in *Cajanus*. The species count is from Van der Maesen

(1986) and not Lackey (1981b). Van der Maesen discussed the relationships of *Dunbaria* and *Cajanus* (10.73), and included six species of *Dunbaria* in synonymies of various species of *Cajanus*. According to Van der Maesen, *Endomallus pellitus* F. Gagnepain and *E. spirei* F. Gagnepain are *Cajanus goensis* J.M. Dalziel. *Cajanus* is widely cultivated throughout the tropics, and 85 percent of its production is in India (Van der Maesen and Somaatmadja 1989, Purseglove 1968). On the Indian subcontinent, it is consumed mainly as dried seeds or pulse, and elsewhere it is commonly consumed as fresh seeds and pods.

Cajanus: *C. cajan* (C. Linnaeus) C.F. Millspaugh (*C–E*), *C.*
spp. (*A–B*). *A*, Fruits ($\times 1.4$); *B*, seeds ($\times 3.4$); *C–D*,
testa ($\times 50$, $\times 1000$); *E*, embryos ($\times 5$).



Genus: *Dunbaria* R. Wight & G.A.W. Arnott

Phylogenetic Number: 10.74.

Tribe: Phaseoleae.

Subtribe: Cajaninae.

Group: Cajaninae.

Species Studied—Species in Genus: 4 spp.—20 spp. (Van der Maesen, personal communication, 1998)

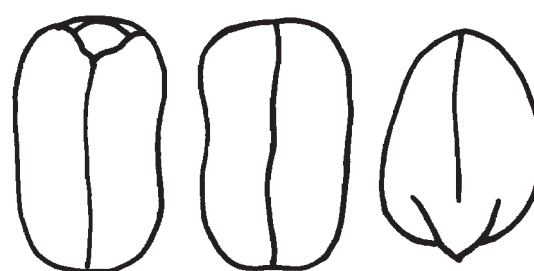
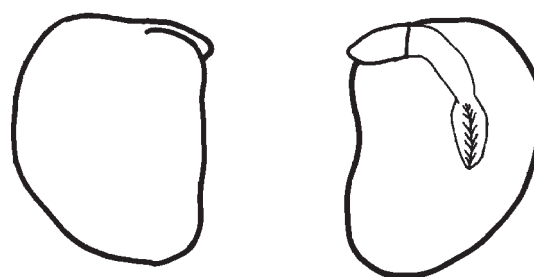
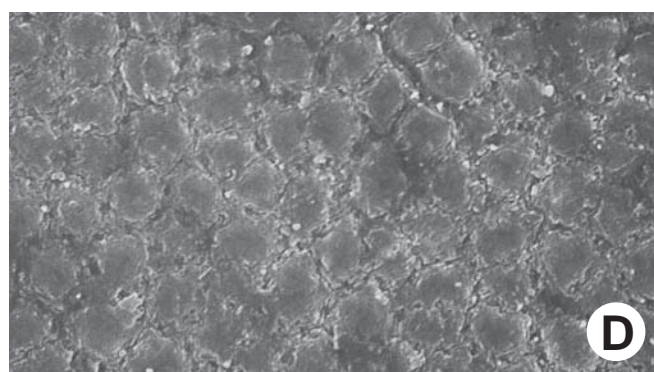
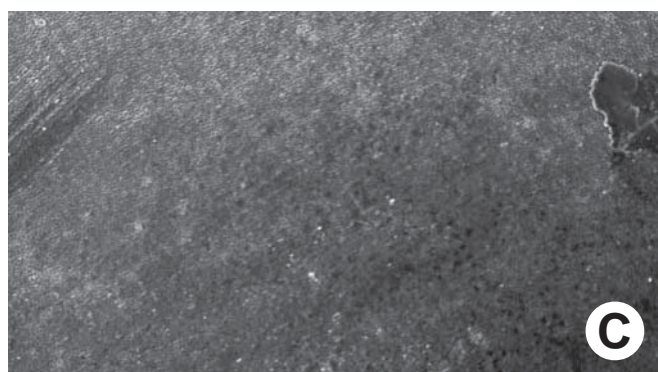
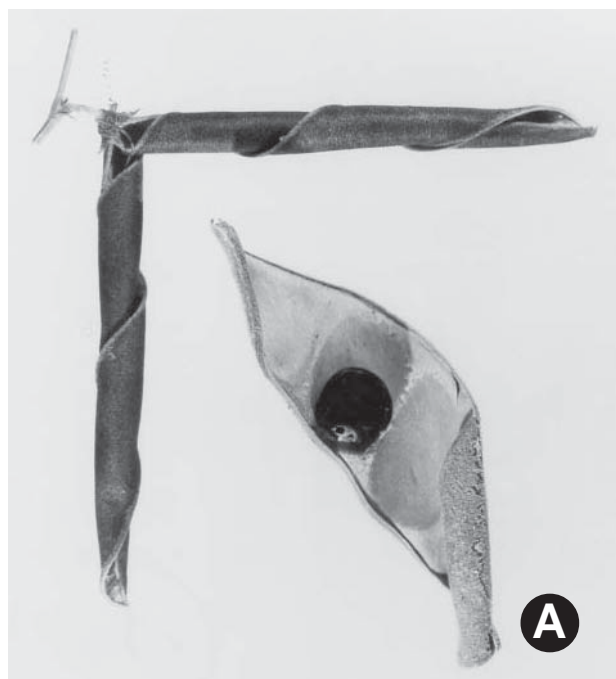
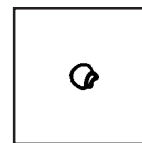
Fruit a legume; unilocular; $1.2\text{--}4.7 \times 0.5\text{--}0.9$ cm; with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; asymmetrical; falcate; when asymmetrical with both sutures parallelly curved; not inflated; compressed; with beak; straight or hooked; with solid beak the same color and texture as fruit; tapered at apex; apex aligned with longitudinal axis of fruit; tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous; seed chambers externally invisible or visible; with the raised seed chambers not torulose. Fruit margin not constricted; without sulcus; plain. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscent; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome; brown or green; pubescent and indurate; with 1 or 2 types of pubescence; puberulent and sericeous or puberulent; with pubescence golden; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain and swollen or plain; glandular or eglandular; with glandular hairs and dots; without spines; not smooth; with elevated features; not veined; not tuberculate; muricate; exfoliating in part; with or without cracks; cracking oblique to fruit length. Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; solid; coriaceous. Endocarp dull; monochrome; brown to tan; smooth; septate; with septa thin (tissue paper-like), flexible; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 4–5(–10) (10 from literature); length transverse to fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; $0.5\text{--}0.6$ mm long; of 1 length only; flattened; triangular. Aril fleshy (and hard); 2-lipped rim-aril; entire; covering less than 1/2 of seed; with tongues (or flap-like) on lips of 2-lipped rim-aril; with 1 tongue or flap on 1 lip of 2-lipped rim-aril or 2 tongues or flaps, 1 on each lip of 2-lipped rim-aril; light brown to cream.

Seed $5\text{--}5.5 \times 4\text{--}4.5 \times 2.4\text{--}3$ mm; not overgrown; not angular or angular; symmetrical; reniform, elliptic, circular, or quadrangular; compressed; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; dull; not modified by a bloom; colored; mottled; with frequent mottles; reddish brown; with black and brown overlay; glabrous; smooth; coriaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum partially or fully concealed; concealed by aril; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; $2.5\text{--}3.5$ mm long; with curved outline; elliptic; apical according to radicle tip but marginal according to seed length; flush; within rim or not within corona, halo, or rim. Hilum rim color darker than testa. Lens discernible; less than 0.5 mm or equal to or greater than 0.5 mm in length; $0.5\text{--}0.7$ mm long; with margins curved; circular; not in groove of raphe; confluent with hilum; mounded; similar color as testa; darker than testa; dark brown; within halo. Lens halo color darker than testa. Endosperm absent. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing radicle; notched at radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; white to tan; inner face flat; glabrous around base of radicle. Embryonic axis right angled; perpendicular to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; linear to triangular; lobe tip straight; deflexed and parallel to cotyledon width; centered between cotyledons; less than 1/2 length of cotyledons. Plumule well developed; glabrous.

Distribution: Asia to Australia.

Notes: Van der Maesen (1986) discussed the relationships of *Dunbaria* and *Cajanus* (10.73). He included six species of *Dunbaria* in synonymies of various *Cajanus* species. Lackey (1981b) included 15 species in *Dunbaria*.

Dunbaria: *D. punctata* (R. Wight & G.A.W. Arnott) G. Bentham (C–E), *D. spp.* (A–B). A, Fruits ($\times 2$); B, seeds ($\times 7.5$); C–D, testa ($\times 50$, $\times 1000$); E, embryos ($\times 8$).



E

Genus: *Bolusaфра* C.E.O. Kuntze

Phylogenetic Number: 10.75.

Tribe: Phaseoleae.

Subtribe: Cajaninae.

Species Studied—Species in Genus: 1 sp.—1 sp.

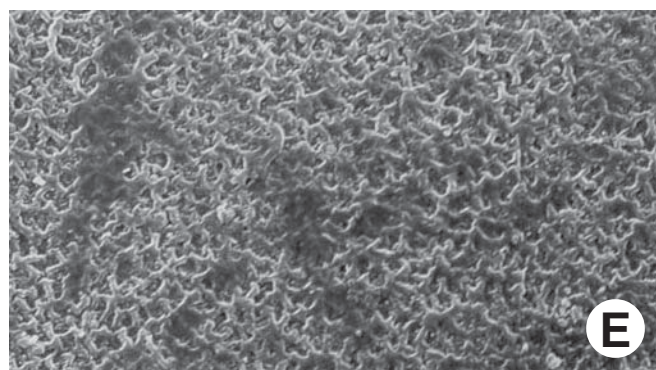
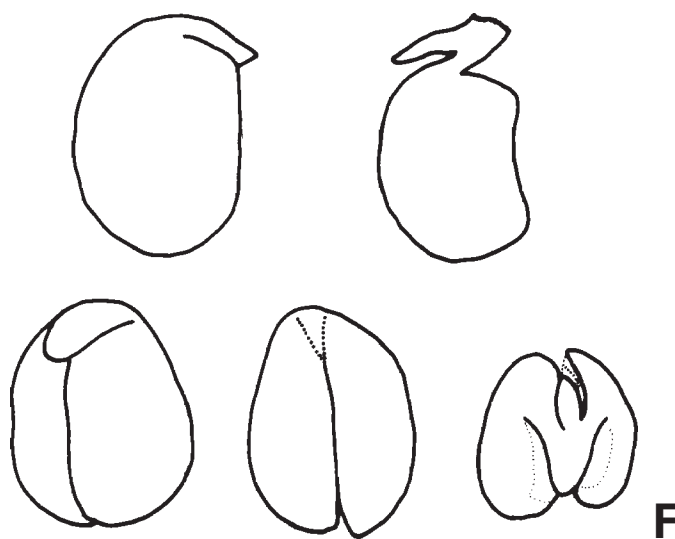
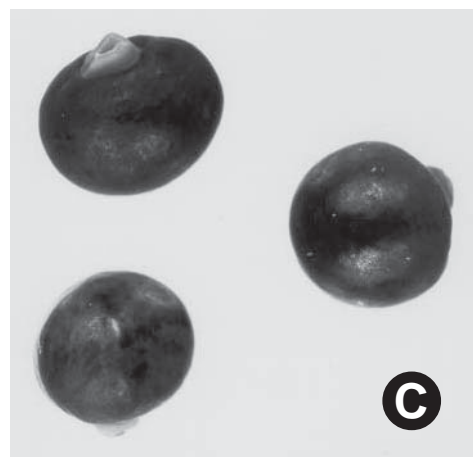
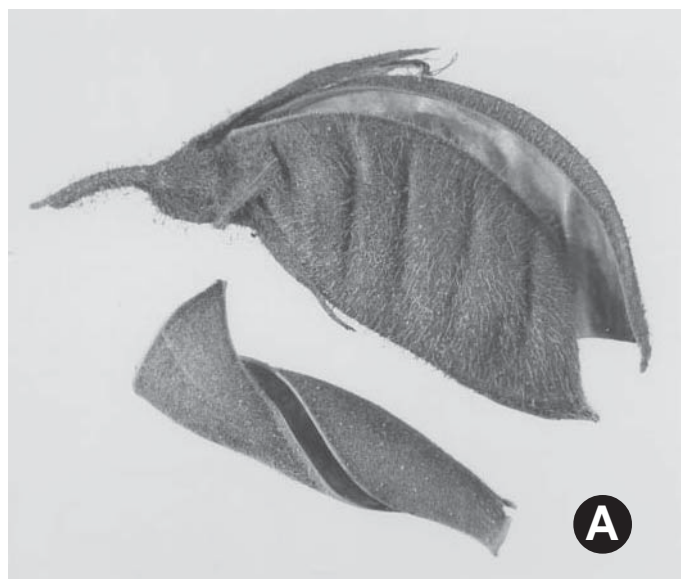
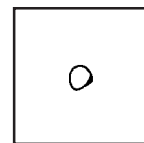
Fruit a legume; unilocular; $2.2\text{--}2.7 \times 0.8\text{--}1.1$ cm; without orifice formed by curving of fruit or fruit segments; straight to curved (slightly); not plicate; not twisted; asymmetrical; reniform or irregular; when asymmetrical with both sutures unequally curved; not inflated; compressed; without beak; short tapered at apex; apex aligned with longitudinal axis of fruit; tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous; seed chambers externally visible; with the raised seed chambers not torulose. Fruit margin not constricted; without sulcus; plain. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome; brown; pubescent and indurate; with 2 types of pubescence; sericeous; with pubescence golden; with pubescence uniformly distributed; with simple and glandular hairs; stiff; with hair bases swollen and plain, swollen, or plain; glandular; with glandular hairs; without spines; smooth; not veined; not tuberculate; not exfoliating; without cracks. Mesocarp thin; 1-layered; without balsamic vesicles; solid; coriaceous. Endocarp dull; monochrome; tan; smooth; nonseptate; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 2–3; length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus less than 0.5 mm long; of 1 length only; flattened; straight. Aril dry; 2-lipped rim-aril; entire; covering less than 1/2 of seed; without tongue (or flap-like) on lips of 2-lipped rim-aril; brown to cream.

Seed $4.1 \times 3.5 \times 3$ mm; not overgrown; not angular; symmetrical; elliptic to reniform; terete; with surface smooth; without visible radicle and cotyledon lobes; with shallow hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; dull; not modified by a bloom; colored; monochrome; reddish brown; glabrous; smooth; coriaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum fully concealed; concealed by aril; with faboid split; with the lips

of the faboid split the same color as the rest of the hilum; larger than punctiform; 1.5 mm long; with curved outline; elliptic; apical according to radicle tip but marginal according to seed length; raised; within rim. Hilum rim color darker than testa. Lens not discernible. Endosperm thin; restricted to region of embryo; adnate to testa. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing radicle; notched at radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; tan; inner face flat; glabrous around base of radicle. Embryonic axis right angled; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; triangular; lobe tip straight; deflexed and parallel to cotyledon width; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

Distribution: South Africa.

Bolusaфра: *B. bituminosa* (C. Linnaeus) C.D.F. Meisner (A–F). A–B, Fruits ($\times 3.2$, $\times 3.3$); C, seeds ($\times 8$); D–E, testa ($\times 50$, $\times 1000$); F, embryos ($\times 10$).



Genus: *Flemingia* W. Roxburgh ex W.T. Aiton

Phylogenetic Number: 10.77.

Tribe: Phaseoleae.

Subtribe: Cajaninae.

Species Studied—Species in Genus: 9 spp.—30 spp.

Fruit a legume; unilocular; $1.5 \times 0.9 \times 0.7$ cm; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; asymmetrical; irregular or harp-shaped; when asymmetrical with both sutures unequally curved; not inflated; terete or compressed; with beak; straight; with solid beak the same color and texture as fruit; short tapered or rounded at apex; apex aligned with longitudinal axis of fruit; rounded or short tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous; seed chambers externally invisible. Fruit margin not constricted; without sulcus; plain. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome; brown; pubescent and indurate; with 1 type of pubescence; puberulent; with pubescence golden; with pubescence uniformly distributed; with simple hairs; stiff; with hair bases swollen or plain; glandular; with glandular dots; without spines; smooth or not smooth; with elevated features; veined or not veined; transversely veined relative to fruit length; not tuberculate; glandular dotted; exfoliating in part or not exfoliating; with or without cracks; cracking oblique to fruit length. Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; chartaceous. Endocarp dull; streaked; tan; with brown or gray overlay; smooth; with hairs scattered over endocarp; nonseptate; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 1 or 2; length oblique to fruit length; neither overlapping nor touching; in 1 series. Funiculus less than 0.5 mm long or measured; up to 1.1 mm long; of 1 length only; flattened; triangular. Aril dry; rim-aril or 2-lipped rim-aril (rarely); entire; covering less than 1/2 of seed; with tongues (or flap-like) on lips of 2-lipped rim-aril; with 1 tongue or flap on 1 lip of 2-lipped rim-aril or 2 tongues or flaps, 1 on each lip of 2-lipped rim-aril (rarely); cream.

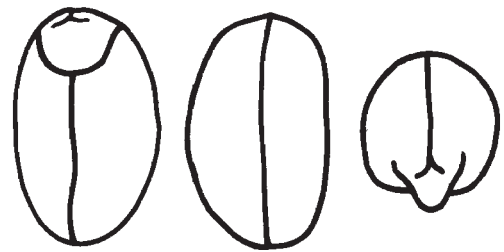
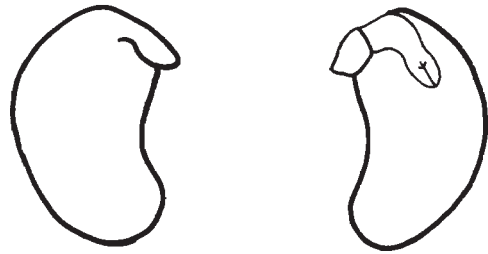
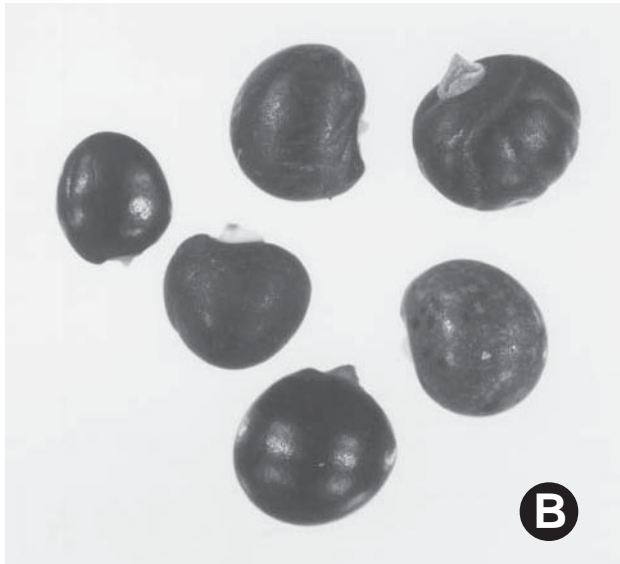
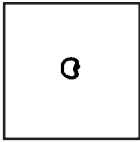
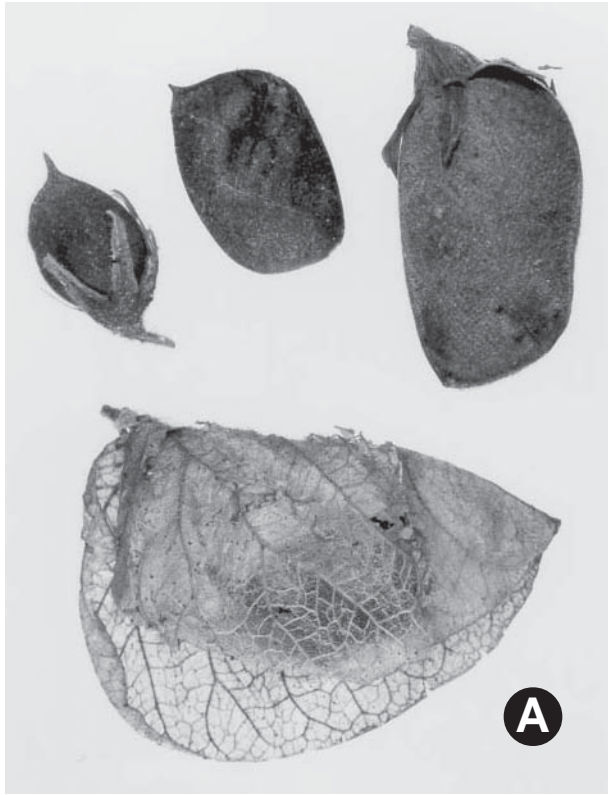
Seed $3\text{--}5.6 \times 2.5\text{--}4.2 \times 2.5\text{--}4.3$ mm; not overgrown; not angular or angular; symmetrical or asymmetrical; circular, irregular, reniform, or rhombic; terete to compressed; with surface smooth; without (mostly) or with visible radicle and cotyledon lobes; without external groove between radicle and cotyledon lobes; with shallow hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; glossy or dull; not modified or modified by a bloom; colored; monochrome or mottled; with frequent mottles; black or brown (dark); with black or brown overlay; glabrous; smooth; coriaceous. Fracture lines present or absent; transverse. Rim absent. Wings absent. Raphe not visible. Hilum partially concealed; concealed by aril; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 1–1.5 mm long; with curved outline; elliptic; apical according to radicle tip but marginal according to seed length or apical at apex of radicle tip (rarely); flush; within rim or rim and halo. Hilum halo color darker than testa. Hilum rim color darker than testa, color of testa, or lighter than testa (rim lighter if with halo). Lens discernible; less than 0.5 mm to equal to or greater than 0.5 mm in length; 0.5 mm long; with margins curved; circular; not in groove of raphe; confluent with hilum; mounded; dissimilar color from testa; darker than testa; brown; within rim. Lens rim color of or darker than testa. Endosperm trace; restricted to region of embryo; adnate to testa. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing radicle; notched at radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; yellow or tan; inner face flat; glabrous around base of radicle. Embryonic axis deflexed or oblique; oblique or perpendicular to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; bulbous or triangular; lobe tip straight; deflexed and parallel to cotyledon width or oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule well developed to rudimentary (rarely); glabrous.

Distribution: Africa to Asia and Australia.

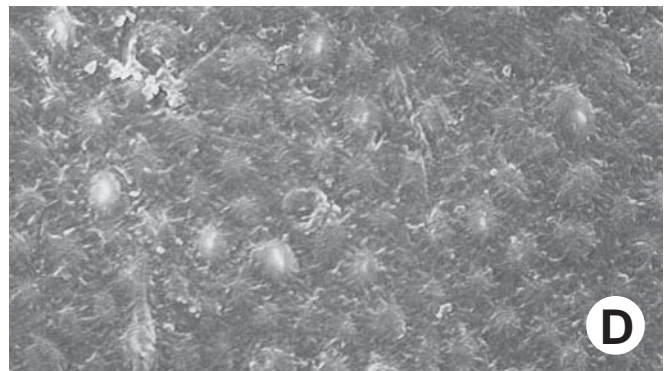
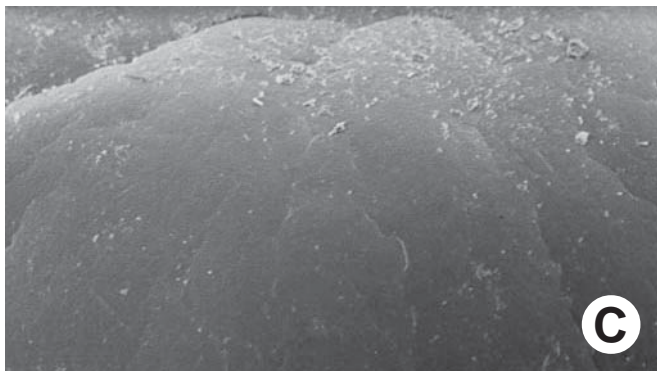
Notes: Hutchinson (1964) described the seeds as estrophiolate; however, rim-arils were present on all species studied, so Hutchinson's interpretation is probably similar to that of Gear and Dengler (1976), which is referred to in the notes for *Eriosema* (10.81).

Flemingia: *F. macrophylla* (C.L. von Willdenow) E.D.

Merrill (*C-E*), *F. spp.* (*A-B*). *A*, Fruits ($\times 3.5$); *B*, seeds ($\times 7.3$); *C-D*, testa ($\times 50$, $\times 1000$); *E*, embryos ($\times 8$).



E



Genus: *Chrysoscias* E.H.F. Meyer

Phylogenetic Number: 10.78.

Tribe: Phaseoleae.

Subtribe: Cajaninae.

Species Studied—Species in Genus: 2 spp.—6 spp.

Fruit a legume; unilocular; $1.7\text{--}2 \times 0.5\text{--}0.7 \times 0.4\text{--}0.5$ cm; with deciduous or persistent calyx; with calyx longer than fruit; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; symmetrical; narrowly elliptic; not inflated; terete; with beak; straight (2–3 mm long); with solid beak the same color and texture as fruit; tapered at apex; apex aligned with longitudinal axis of fruit; tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; chartaceous; seed chambers externally invisible. Fruit margin constricted; without sulcus; plain. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome; brown; with surface texture uniform; pubescent and indurate; with hairs erect; with 1 type of pubescence; velutinous; with pubescence white or yellowish white; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases swollen (yellow); antrorse; straight at apex; eglandular; without spines; not smooth; with recessed features; not veined; not tuberculate; obliquely, shallowly grooved; not exfoliating; without cracks. Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; without fibers; without reniform canals; solid; chartaceous. Endocarp glossy; opaque; monochrome; white; smooth; without adhering pieces of testa; nonseptate; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 1 or 2; length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; ca. 0.5 mm long; flattened; broadly triangular. Aril fleshy; 2-lipped rim-aril; entire; covering less than 1/2 of seed; without tongue (or flap-like) on lips of 2-lipped rim-aril.

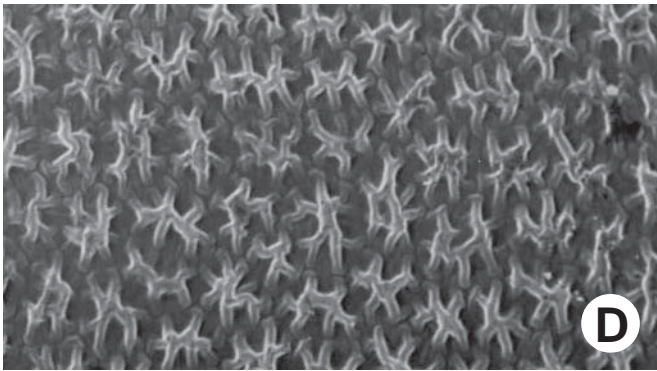
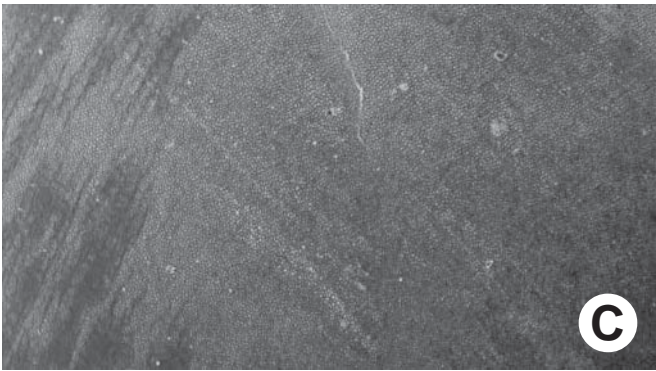
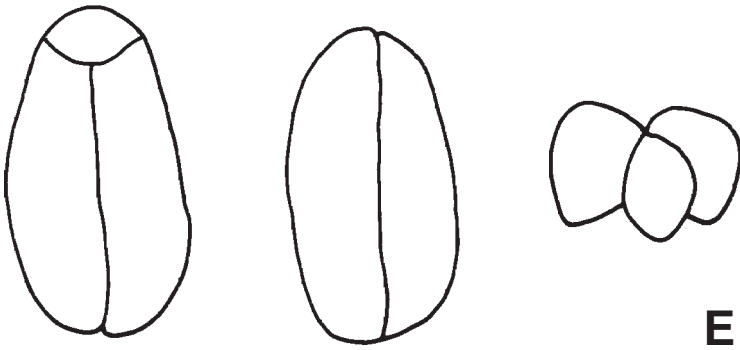
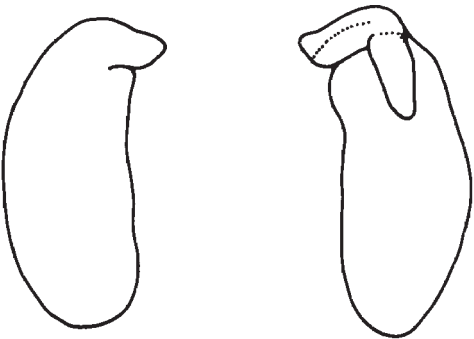
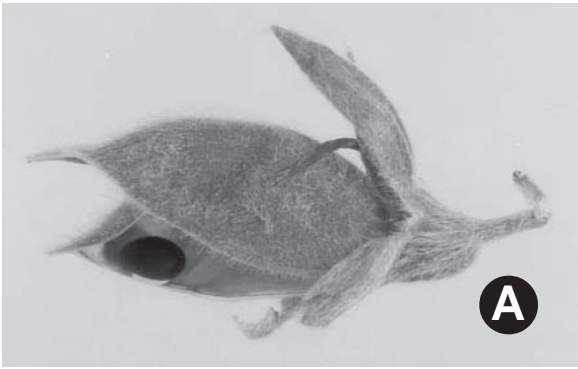
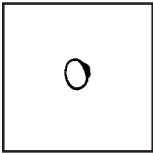
Seed $3.6\text{--}4.7 \times 3\text{--}3.7 \times 2.7\text{--}3$ mm; not overgrown; not angular; symmetrical; ovate; compressed; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces; without medial ridge on each face. Testa not adhering

to endocarp; free from endocarp; dull to glossy; not modified by a bloom; colored; mottled or monochrome; with frequent mottles; black or brown (dark); with brown overlay; glabrous; smooth; coriaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum partially concealed; concealed by aril; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 1.5–2.8 mm long; with curved outline; elliptic; marginal according to radicle tip; recessed; within halo or not within corona, halo, or rim. Hilum halo color lighter than testa. Lens discernible; equal to or greater than 0.5 mm in length; 0.5–0.8 mm long; with margins straight; linear; not in groove of raphe; confluent with hilum; recessed or flush; same color as testa; black or brown; within halo. Lens halo color lighter than testa. Endosperm absent. Cotyledons smooth; with 2 outer faces on each cotyledon, one flat and the other convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; not concealing radicle; entire over radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; dark brown; inner face flat; glabrous around base of radicle. Embryonic axis deflexed; oblique to length of seed; with a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; linear; lobe tip straight; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

Distribution: South Africa.

Notes: The status of *Chrysoscias* is ambiguous. It has been maintained as a genus (Lackey 1981b, Polhill 1994b) and synonymized under *Rhynchosia* (10.80) (Gear 1978, Arnold and Wet 1993). Pending detailed studies, we accept it as a genus.

Chrysoscias: *C. argentea* (C.P. Thunberg) C.A. Smith (A, C–E), *C. parviflora* E.H.F. Meyer (B). A, Fruits ($\times 3.2$); B, seed ($\times 10.3$); C–D, testa ($\times 50$, $\times 1000$); E, embryos ($\times 16$).



Genus: *Rhynchosia* J. de Loureiro

Phylogenetic Number: 10.80.

Tribe: Phaseoleae.

Subtribe: Cajaninae.

Species Studied—Species in Genus: 29 spp.—200 spp.

Fruit a legume; unilocular; $0.4\text{--}5.5 \times 0.3\text{--}1.2 \times 0.2\text{--}0.5$ cm; with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight to curved (slightly); not plicate; assumed not twisted; asymmetrical; falcate, ovate, harp-shaped, or irregular; when asymmetrical with both sutures parallelly or unequally curved; not inflated; compressed or terete (Gear 1978); with or without (rarely) beak; straight or declined; with solid beak the same color and texture as fruit; tapered or short tapered at apex; apex aligned or oblique with longitudinal axis of fruit; long tapered, tapered, or short tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous; seed chambers externally visible to invisible; with the raised seed chambers not torulose. Fruit margin not constricted; without sulcus; plain. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; assumed apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome or multicolored; mottled; brown, green, or tan; with green or brown (dark, rarely) overlay; with mottling over seed chambers; pubescent and indurate; with 1 or 2 types of pubescence; puberulent, puberulent and pilose, or pilose (rarely); with pubescence golden or white; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases swollen and plain, swollen, or plain; glandular or eglandular; with glandular hairs and dots; without spines; not smooth; with elevated features; irregularly veined or obliquely veined relative to fruit length (rarely); not tuberculate; glandular dotted, pusticulate, scurfy, or wrinkled (rarely); not exfoliating; with or without cracks; cracking transverse to fruit length. Mesocarp present or absent; thin or thick (rarely); 1-layered; without balsamic vesicles; with or without (rarely) fibers; fibrous throughout or solid; chartaceous or ligneous (rarely). Endocarp dull or glossy; monochrome, mottled, or streaked (rarely); tan, yellow, or white (rarely); with mottling over seed chambers; with brown or yellow (rarely) overlay; cobwebby, smooth, smooth and floury-filamentous, or

scurfy and smooth (rarely); nonseptate; coriaceous or chartaceous; not exfoliating; remaining fused to mesocarp and epicarp or to epicarp; entire. Seeds 2 or 1; length parallel with or oblique to fruit length; neither overlapping nor touching; in 1 series. Funiculus less than 0.5 mm long or measured; up to 1 mm long; of 1 length only; flattened; triangular or curved. Aril hard fleshy or dry; when fleshy caplike; entire; covering less than 1/2 of seed; when dry rim-aril or 2-lipped rim-aril; entire; covering less than 1/2 of seed; without tongue (or flap-like) on lips of 2-lipped rim-aril or with tongues (or flap-like) on lips of 2-lipped rim-aril; with 2 tongues or flaps, 1 on each lip of 2-lipped rim-aril; cream to tan.

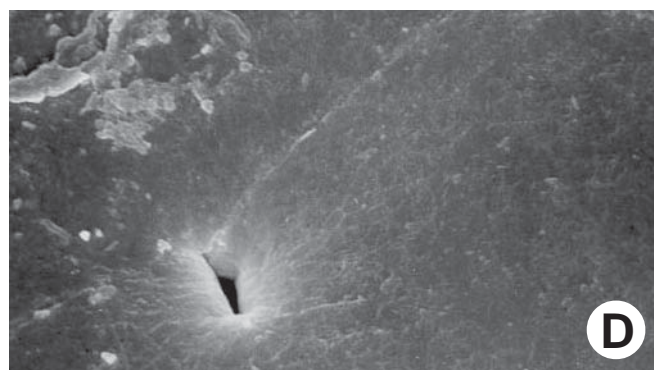
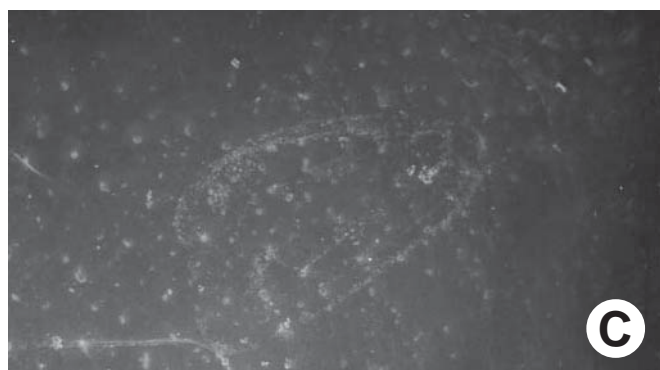
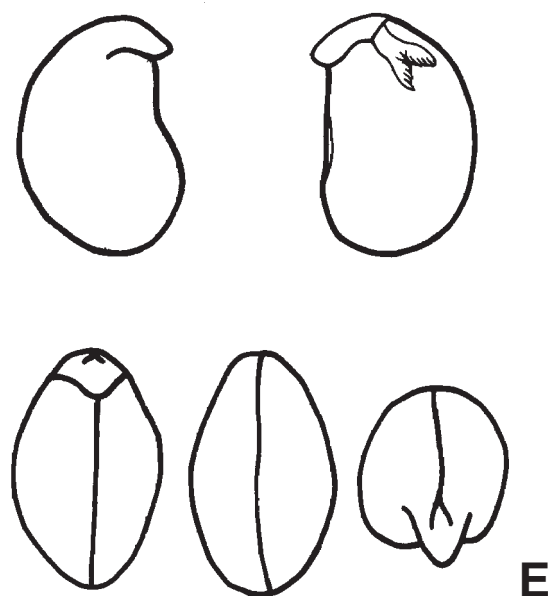
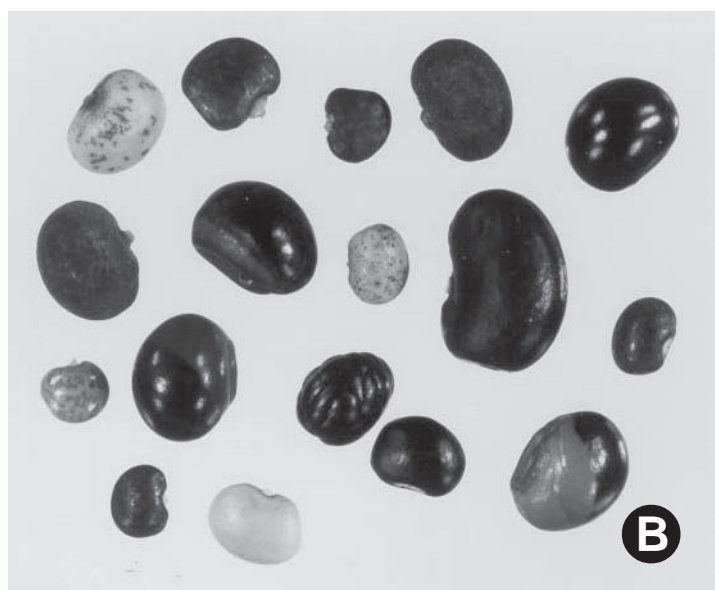
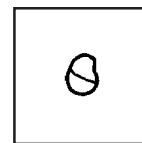
Seed $2.5\text{--}9.5 \times 2\text{--}6.4 \times 1.3\text{--}5.1$ mm; not overgrown; not angular; symmetrical or asymmetrical; cordate, elliptic, ovate, reniform, or bilobed, cicerlike; terete, compressed, or flattened; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; dull to glossy; not modified by a bloom; colored; monochrome, bichrome, or mottled; with frequent mottles; black and red, brown, tan, black, or yellow; with black, brown, or gray overlay; glabrous; smooth or not smooth; with elevated or recessed features; tuberculate; pitted with small separate pits; coriaceous. Fracture lines present or absent; transverse. Rim absent. Wings absent. Raphe not visible. Hilum visible, partially concealed, or fully concealed; concealed by aril; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; $0.5\text{--}3.5$ mm long; with curved outline; circular, elliptic, or oval; apical according to radicle tip but marginal according to seed length; flush or recessed; within rim or rim and halo. Hilum halo color darker than testa. Hilum rim color of, lighter than, or darker than testa. Lens discernible; less than 0.5 mm to equal to or greater than 0.5 mm in length; $0.5\text{--}2.1$ mm long; with margins straight or curved; linear; elliptic; not in groove of raphe; confluent with hilum; mounded or flush; dissimilar color from testa; lighter or darker than testa; black, brown, or purple; within rim or halo or not within corona, halo, or rim. Lens halo color darker than testa. Lens rim color darker than testa. Endosperm trace; not pluglike and not resembling tip of radicle or pluglike and resembling tip of radicle (rarely); restricted to region of embryo; adnate to testa. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing radicle; notched at

radicle; without lobes; with the interface division terminating at base of radicle; without or with 1 margin recessed; recessed on side opposite from radicle; tan; inner face flat; glabrous around base of radicle. Embryonic axis deflexed or oblique; oblique or perpendicular to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; bulbous; lobe tip straight; deflexed and parallel to cotyledon length or width or oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule moderately to well developed; glabrous.

Distribution: Pantropics.

Notes: Grear (1978) monographed the New World species. Labat and Du Puy (1996) synonymized *Baukea* G.C.W. Vatke (10.76) with *Rhynchosia*. The specific epithet of the single *Baukea* species could not be transferred into *Rhynchosia*, so they created the new name *R. baukea* J.-N. Labat & D.J. Du Puy for it. Other faboid taxa with red and black seeds are *Abrus precatorius* (5.01), which are deadly poisonous, and some species of *Ormosia* (2.15).

Rhynchosia: *R. phaseoloides* (O.P. Swartz) A.-P. de Candolle (*C-E*), *R. spp.* (*A-B*). *A*, Fruits ($\times 2.5$); *B*, seeds ($\times 3.3$); *C-D*, testa ($\times 50$, $\times 1000$); *E*, embryos ($\times 5$).



Genus: *Eriosema* (A.-P. de Condolle) H.G.L.R.
Reichenbach

Phylogenetic Number: 10.81.

Tribe: Phaseoleae.

Subtribe: Cajaninae.

Group: Cajaninae.

Species Studied—Species in Genus: 19 spp.—130 spp.

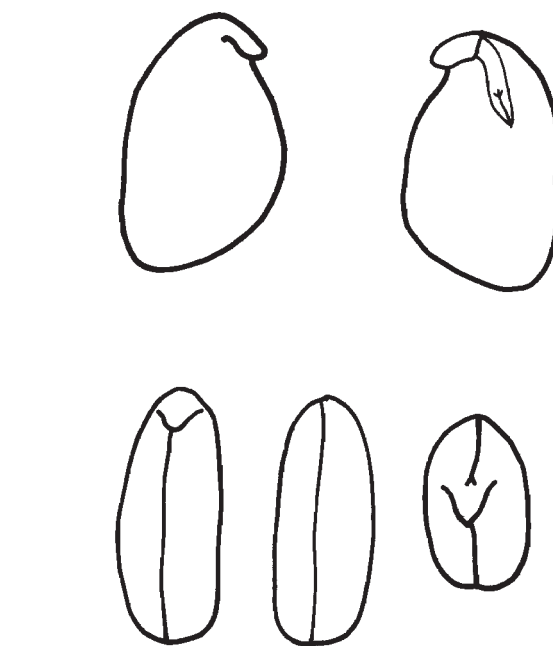
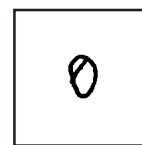
Fruit a legume; unilocular; $1-1.8 \times 0.7-1 \times 0.4$ cm; with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; slightly curved; not plicate; not twisted; asymmetrical; irregular or reniform; when asymmetrical with both sutures unequally curved; not inflated; compressed; with beak; straight or declined; with solid beak the same color and texture as fruit; rounded at apex; apex oblique, right-angled, or aligned with longitudinal axis of fruit; rounded or short tapered at base; base aligned or oblique with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous; seed chambers externally invisible or visible. Fruit margin not constricted; without sulcus; plain. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome; reddish brown; pubescent and indurate; with 2 types of pubescence; sericeous to tomentose and villous or pilose; with pubescence golden; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain and swollen, plain, or swollen; eglandular or glandular; with glandular dots; without spines; not smooth or smooth; with elevated features; not veined; not tuberculate; muricate; without cracks. Mesocarp thin; 1-layered; without balsamic vesicles; solid; chartaceous. Endocarp dull; monochrome or mottled; tan or brown; with mottling over seed chambers; with brown or gray overlay; smooth; nonseptate; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 1 or 2; length transverse or oblique to fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; $0.5-0.6$ mm long; of 1 length only; flattened; straight or triangular. Aril fleshy; 2-lipped rim-aril; entire or crenate; covering less than $1/2$ of seed; without or with tongues (or flap-like) on lips of 2-lipped rim-aril; with 2 tongues or flaps, 1 on each lip of 2-lipped rim-aril.

Seed $4.5-8.5 \times 2.7-5.5 \times 2-3.5$ mm; not overgrown; not angular; symmetrical or asymmetrical; oblong, elliptic, or quadrangular (rarely); compressed to terete (nearly); with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; glossy; not modified by a bloom; colored; monochrome or mottled; with frequent mottles; black or brown (reddish); with brown overlay; glabrous; smooth; coriaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum fully to partially concealed; concealed by aril; with faboid split; larger than punctiform; $4-6.2$ mm long; with straight outline; linear; apical according to radicle tip but marginal according to seed length; raised to flush; within rim. Hilum rim color darker or lighter than testa. Lens discernible; less than 0.5 mm to equal to or greater than 0.5 mm in length; 0.5 mm long; with margins curved; punctiform; not in groove of raphe; confluent with hilum; mounded; similar color as testa; lighter or darker than testa; light brown; within rim. Lens rim color darker than testa. Endosperm present or absent; trace; restricted to region of embryo; adnate to testa. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing radicle; notched at radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; white; inner face flat; glabrous around base of radicle. Embryonic axis oblique or right angled; oblique or perpendicular to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; bulbous to triangular; lobe tip straight to curved; deflexed and parallel to cotyledon length or width or oblique to cotyledons; centered between cotyledons; less than $1/2$ length of cotyledons. Plumule moderately to well developed; glabrous.

Distribution: Pantropics.

Notes: Grear (1970) monographed the American species, and Jacques-Felix (1971) monographed the species of central and eastern Africa. Grear and Dengler (1976) studied the rim-aril of *Eriosema glaziovii* H.A.T. Harms and discussed its importance in distinguishing *Eriosema* from *Rhynchosia*. They also discussed the misinterpretation of *Eriosema* seeds as estrophiolate by Hutchinson (1964) and Benthham (1865).

Eriosema: *E. floribundum* G. Benthham (C-E), *E. spp.* (A-B). A, Fruits ($\times 2.2$); B, seeds ($\times 4.3$); C-D, testa ($\times 50$, $\times 1000$); E, embryos ($\times 6$).



Genus: *Paracalyx* S.I. Ali

Phylogenetic Number: 10.82.

Tribe: Phaseoleae.

Subtribe: Cajaninae.

Species Studied—Species in Genus: 2 spp.—6 spp.

Fruit a legume; unilocular; $1.9 \times 0.8 \times 0.5$ cm; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; asymmetrical; fusiform or reniform; when asymmetrical with both sutures unequally or parallelly curved; not inflated; compressed; with beak; straight or declined; with solid beak the same color and texture as fruit; tapered to short tapered at apex; apex aligned with longitudinal axis of fruit; tapered or short tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous; seed chambers externally visible; with the raised seed chambers not torulose. Fruit margin not constricted; without sulcus; plain. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; assumed apical and down; active; with valves breaking. Replum invisible. Epicarp dull; monochrome; brown to yellow; pubescent and indurate; with 2 types of pubescence; puberulent; with pubescence golden; with pubescence uniformly distributed; with simple and glandular hairs; pliable; with hair bases swollen and plain; glandular; with glandular hairs; without spines; smooth or not smooth; with elevated features; veined or not veined; reticulately veined; not tuberculate; glandular dotted; not exfoliating; without cracks. Mesocarp thin; 1-layered; without balsamic vesicles; without fibers; mealy; chartaceous. Endocarp dull; mottled; with mottling (dark); with tan overlay; smooth; nonseptate; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 1 or 2; length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus less than 0.5 mm long; of 1 length only; flattened; triangular. Aril dry; 2-lipped rim-aril; entire; without or with tongues (or flap-like) on lips of 2-lipped rim-aril; with 1 tongue or flap on 1 lip of 2-lipped rim-aril; cream or white.

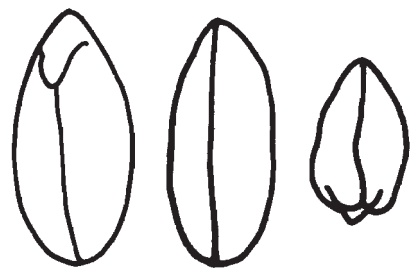
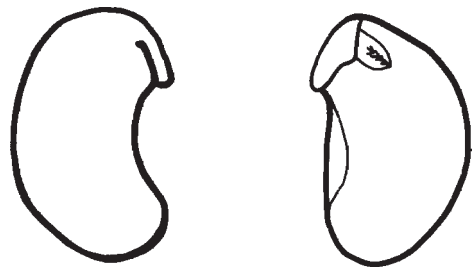
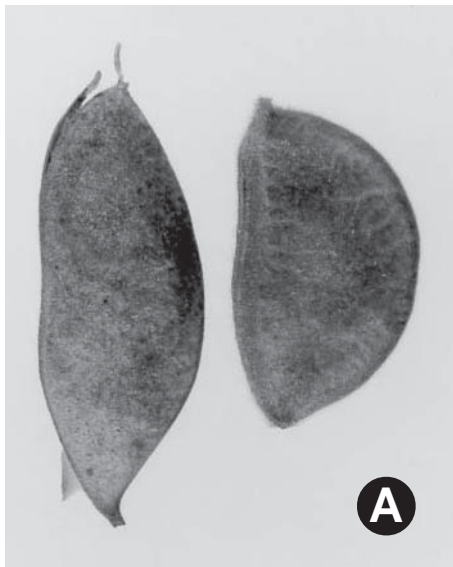
Seed $6-9.5 \times 4-6 \times 3-5.5$ mm; not overgrown; not angular; symmetrical; reniform; terete; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa

not adhering to endocarp; dull; not modified by a bloom; colored; mottled; with frequent mottles; dark brown or green; with black or brown overlay; glabrous; smooth; coriaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum visible; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 1–2 mm long; with curved outline; elliptic; apical according to radicle tip but marginal according to seed length; recessed; within rim. Hilum rim color of testa. Lens discernible; equal to or greater than 0.5 mm in length; 0.7–1 mm long; with margins curved; elliptic; not in groove of raphe; confluent with hilum; flush; dissimilar color from testa; darker than testa; black; not within corona, halo, or rim. Endosperm trace; restricted to region of embryo; adnate to testa. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing radicle; notched at radicle; without lobes; with the interface division terminating at base of radicle; with 1 margin recessed or without margins recessed; recessed on same side as radicle; pale tan; inner face flat; glabrous around base of radicle. Embryonic axis oblique; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; linear; lobe tip straight; deflexed and parallel to cotyledon length or oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule moderately developed; glabrous.

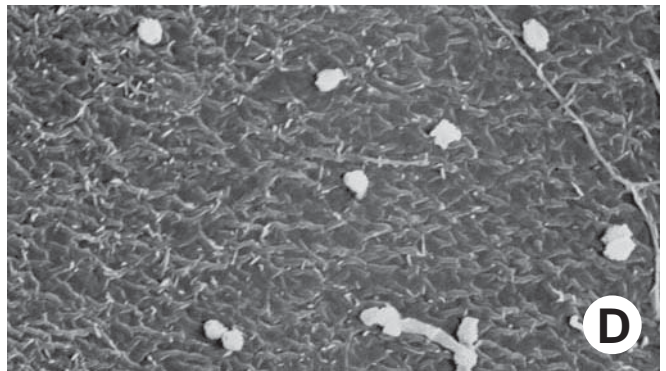
Distribution: Africa to Asia.

Notes: Only one whole fruit was studied.

Paracalyx: *P. scariousus* (W. Roxburgh) S.I. Ali (*C–E*), *P.* spp. (*A–B*). *A*, Fruits ($\times 3.6$); *B*, seeds ($\times 6.9$); *C–D*, testa ($\times 50$, $\times 1000$); *E*, embryos ($\times 6$).



E



Genus: *Adenodolichos* H.A.T. Harms

Phylogenetic Number: 10.83.

Tribe: Phaseoleae.

Subtribe: Cajaninae.

Group: Cajaninae.

Species Studied—Species in Genus: 3 spp.—15 spp.

Fruit a legume; unilocular; $3\text{--}5.2 \times 1.2\text{--}1.5$ cm; with persistent or deciduous calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; curved; not plicate; not twisted; asymmetrical; C-shaped; when asymmetrical with both sutures parallelly curved; not inflated; compressed; without beak; short tapered at apex; apex oblique with longitudinal axis of fruit; tapered at base; base aligned or right angled with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous; seed chambers externally invisible. Fruit margin not constricted; without sulcus; plain. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome; brown to reddish brown; pubescent and indurate or pubescent but soon deciduous; with 1 or 2 types of pubescence; pilose; with pubescence brown (reddish) or golden; with golden glandular hairs and short-pilose reddish-brown intermixed; with pubescence uniformly distributed; with simple and glandular hairs (sometimes); pliable; with hair bases swollen and plain, swollen, or plain; glandular; with glandular hairs; without spines; not smooth; with elevated features; reticulately veined; not tuberculate; wrinkled; without cracks. Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; solid; coriaceous. Endocarp dull and glossy (usually under seed); monochrome; tan; smooth; subseptate; with septa thin (tissue paper-like), flexible; with septa eglandular; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 1 or 2; length parallel with or transverse to fruit length; neither overlapping nor touching; in 1 series. Funiculus less than 0.5 mm long; of 1 length only; flattened; straight. Aril dry; rim-aril; entire; gray to tan.

Seed $6.5\text{--}9.5 \times 5.5\text{--}8.7 \times 2.6\text{--}4.1$ mm; not overgrown; not angular; symmetrical; circular; compressed; with surface smooth; without visible radicle and cotyledon lobes; with shallow hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; glossy; not modified or modified by a bloom; colored; monochrome; reddish to dark brown; glabrous; smooth or not smooth; with recessed features; large depressions on each face; coriaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum partially concealed; concealed by funicular remnant; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 2 mm long; with straight outline; linear; apical according to radicle tip but marginal according to seed length; recessed; within rim. Hilum rim color of or lighter than testa. Lens discernible; equal to or greater than 0.5 mm in length; up to 1 mm long; with margins straight; linear; not in groove of raphe; confluent with hilum; mounded; same color as testa; not within corona, halo, or rim or within rim. Lens rim color of testa. Endosperm trace; restricted to region of embryo; adnate to testa. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; not concealing radicle; notched at radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; white to tan; inner face flat; glabrous around base of radicle. Embryonic axis oblique to right angled; oblique or perpendicular to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; linear; lobe tip straight; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule moderately developed; glabrous.

Distribution: Tropical Africa.

Adenodolichos: *A. punctatus* (M. Micheli) H.A.T. Harms (C–E), *A. spp.* (A–B). *A*, Fruits ($\times 1.4$); *B*, seeds ($\times 4.9$); *C–D*, testa ($\times 50$, $\times 1000$); *E*, embryos ($\times 5$).

